PROVISION OF EXTENSION SERVICES TO SUPPORT COMMERCIAL AQUACULTURE ENTERPRISE DEVELOPMENT IN AFRICA

GUIDELINES TO SUPPORT DEVELOPMENT OF Viable AQUACULTURE EXTENSION SERVICE MODELS IN AFRICA
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FOREWARD

The supply of fish within Africa to meet its own demand has progressively been depreciating. On average, about 17% of human animal protein requirements comes from consuming fish in Africa. However, the current fishery production trends are not growing proportionately to Africa’s population growth and fish food needs. It is forecast, the unless Africa finds an alternative sustainable fish production source to augment the fisheries given its demographic environment, the continent shall continue to experience substantive falls in fish supply, fish consumption and livelihoods accruing from the sector.

Africa’s strategy to address these challenges is reiterated in The Policy Framework and Reform Strategy for Fisheries and Aquaculture in Africa. This provides Africa’s guiding framework for the transformation of the sector in lieu of the Comprehensive Africa Agriculture Development Program (CAADP) (AU-IBAR/NEPAD, 2014; NEPAD 2015). The PFRS identifies market-oriented sustainable aquaculture development as the most sustainable option for reducing the gap in fish production and supply. The basis for this stems from Africa’s vast suitable natural resources, growing employable young population and its growing markets. Without the right knowledge and skills, however, the sustainable commercial aquaculture development goals will not be realised. The need to have in place parameters and actions to help re-orient and build human resource capacity to support Africa’s emerging commercial aquaculture sector were among the key priority actions raised by stakeholders (AU-IBAR/NEPAD 2015; AU-IBAR, 2018).

These guidelines were subsequently formulated during a Expert Consultative Workshop to Formulate Guidelines for Developing Aquaculture Business Models and Enhancing Extension Services held in Accra, Ghana, from 24 to 25 July 2017. 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 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 the aquaculture sector to generate wealth, social benefits and to contribute to the development of the African economy. However, producers experience in the sector has been marked with high rates of failure due to lack of guidance. For this to materialise, the knowledge and skills base within the African aquaculture sector must be developed and expanded through effective extension services.

In Africa, high rates of aquaculture failure continue to occur due to lack of guidance. Accordingly, there is a vast need for the application of appropriate and effective extension services. A paradigm shift in the approach to aquaculture development on the continent requires the transformation of extension services to better support aquaculture value chain and enterprise development. This guideline seeks to support this paradigm shift, which can ultimately lead to tangible benefits for the people of Africa.

In the guideline, effective extension services are 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.

The guidelines show the importance of “whole-value-chain” extension and explores the content of effective extension programmes. For these programmes to be effective, Governments need to identify and upskill extension officers. A clear differentiation must be made between the knowledge extension officers have and their ability to transform this knowledge into skills that result into successful aquaculture business.

These guidelines unpack a range of extension models, from basic exposure to advanced teaching at universities and training institutions, through to the role of aquaculture associations, and other participants in the aquaculture value chain. Importantly, the guidelines highlight the potential role of the social media in aquaculture extension on the Continent.

The consultative meeting recommended the following as among Best Extension Practices to support the transformation African Aquaculture: (i) sensitivity to language, culture and education level, (ii) handle the entire range of skills required to operate and enhance the
viability aquaculture businesses across aquaculture value chains, (iii) relevance of extension materials, (iv) ensure materials are up-to-date, (v) embrace local knowledge, (vi) focus at turning knowledge into skills, (vii) foster entrepreneurship, (viii) ensure extension materials remain market oriented, (ix) keep programs innovative and (x) include sustainable environmental management. A range of crosscutting issues have been included to ensure that the continental extension guidelines apply across the African aquaculture landscape. The crosscutting issues include gender and youth involvement, social responsibility, occupational safety, sustainable environmental management, good governance and climate change.

The guidelines provide basic principles for improving the quality and re-orientation of aquaculture extension services to provide the knowledge and skills need for sustainable commercial aquaculture development. The adoption of these guidelines by both public and private stakeholders will promote a coherent approach for the dissemination and access to the appropriate information and skills necessary to transform the sector.

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.
SECTION A: INTRODUCTION

1. Context to the Guidelines

In 2014, the Joint Conference of African Ministers of Agriculture, Rural Development, Fisheries and Aquaculture recognized the potential of the aquaculture sector to generate wealth, social benefits and contribute to the development of the African economy. This recognition stemmed 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 9.8 kg per capita per annum, while the global average has risen to approximately 19.7 kg per capita per annum (FAO, 2016). The likelihood that capture fishery production can be increased to meet this demand is low because Africa’s commercially important fish stocks are fully or over exploited (FAO, 2016). Africa has consequently become a net importer of fish. Under these circumstances, aquaculture offers the most sustainable option for the continent to expand its fish supply. To achieve this, there is a need for a paradigm shift in the approach to aquaculture, which shift will 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. The paradigm shift is required support the transformation of smallholder subsistence aquaculture into commercial production units that can benefit from value-chains to access and supply wider markets.
2. African Policy Environment for Aquaculture

The Policy Framework and Reform Strategy (PFRS) for Fisheries and Aquaculture, and the objectives of the Comprehensive Africa Agriculture Development Programme (CAADP), have informed the initiative to create guidelines for aquaculture extension services, and the development of best extension service 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 can meet the objectives of CAADP.
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 unlocking Africa’s aquaculture potential and the transformation of the sector into a globally competitive source of aquatic products. This in turn, necessitates the adoption of an approach hinged on private-sector development in a sustainable and equitable manner.

It is recognised that each country has different opportunities and capabilities for commercial aquaculture. To address this, the PFRS emphasises regional integration whereby the flow of aquaculture goods and services between and within regional markets is acquiesced to and encouraged.

3. **Purpose and Objectives of the Guideline**

The primary objective of the guideline is to strengthen aquaculture extension services in Africa. The guideline details a selection of appropriate aquaculture extension service models and best practices related there to, based on continental and globally relevant industry experiences.

The specific objectives of these aquaculture extension guidelines are to build capacity for:

- The transformation and broadening of aquaculture value chains in Africa.
- The creation of a critical pool and network of up-to-date and relevant extension services.
- Improved market access.
- Enhancing the growth and expansion of African aquaculture in terms of volume, value and range of products.
- Human resource capacity to effectively engage and derive benefits from sustainable commercial aquaculture.
- The positive use of social media as a tool to enhance the provision of aquaculture extension services.
- To enhance the gender and youth participation and social advancement.
- The adoption of sustainable environmental practices and climate change mitigation strategies in the sector.
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 of the fact 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 all aquaculture sector participants and stakeholders along the entire value chain, including public and private sector involved in primary production, supply and services. Consequently, the guidelines are applicable to governments, Regional Economic Communities (RECs), NGO’s, producer organisations, researchers, traders, financial institutions and other role players. They hold value not only for small holder and subsistence farmers, but also for industrial scale and large scale aquaculture enterprises.

5. **Structure of the Guideline**

This guideline is divided into six distinct sections for ease of reference and use. The structure is as follows:

- **Section A** The introduction, including the context of the document, the policy environment, objectives, scope, audience and application.
- **Section B** The core elements of effective extension, including a definition, the importance of extension across the value chain, content, identifying extension officers and the role of social media. Participants views and experiences.
- **Section C** The extension model options for Africa.
- **Section D** Best extension service practices, including prospective constraints, relevance, keeping information up-to-date, nurturing entrepreneurship and more.
- **Section E** Crosscutting matters such as gender and youth empowerment, social matters, occupational safety, environmental responsibility, good governance and climate change.
- **Section F** Conclusion, dissemination of information and the ideal aquaculture extension service model at national level.
6. **Application of the Guidelines**

The guidelines provide a framework for enhancing the capacity of aquaculture extension services to provide the practical knowledge and skills required by both public and private sector actors in Africa’s emerging commercial aquaculture value chains. It should be considered flexible and tailored to address local needs. They are applicable at national, regional and continental level.
SECTION B: CORE ELEMENTS OF EFFECTIVE EXTENSION

The establishment and operation of effective extension services is an essential driver for the paradigm shift required to transform African aquaculture from a predominantly small-scale subsistence farm activity into a competitive agricultural sub-sector.

In Africa, the cultural experience and exposure of the youth to livestock and crop farming results in a traditional competence in these sectors – at least for most non-urbanised people. The knowledge and skills for the development and operation of aquaculture is novel and has not developed ‘organically’ over eons. The acquisition of the necessary practical knowledge and skills for aquaculture requires training, hence the need for effective extension services.

1. Effective Extension Services

In these guidelines, ‘effective extension services’ are defined as being 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.

The components of this definition are:

The transfer: referring to the process.
of relevant: meaning specific and applicable.
practical aquaculture knowledge and skills: defining what must be transferred to create the ability of the target audience to ‘do’ successfully.
to new entrants and existing participants: identifying the target audience.
in an accurate and timely manner: meaning when and how.
that can contribute to the success: indicating the goal.
of aquaculture value chains: and impacting on what.

In all instances, extension services must remain result and benefit oriented to justify the inputs and costs, as well as be accessible, accurate and relevant.
2. **Whole Value Chain Extension**

In the past, aquaculture extension in Africa focused at the knowledge and skills required to grow fish. Husbandry techniques and some on-farm processing to reduce spoilage or add value were the main focus with some exposure to hatchery techniques. However, the PFRS’ market-oriented private-sector led sustainable aquaculture development policy objectives calls for the linkage between production and markets. This ideological shift demands a value-chain approach whose development is based upon sound scientific and business principles implemented by competent actors in functional markets. Appropriate extension services tailored to the capacity needs of the various actors along the emerging aquaculture production-market value-chains therefore becomes indispensable.

![Figure 4](image_url) *A basic aquaculture value chain.*

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.

Advancement from the basic value-chain illustrated in figure 4, requires additional knowledge and skills. These knowledge and skills can develop organically over time, but this is a slow process based upon trial and error; that is often limited by the inability of operators to access additional value-chain elements such as improved feed, seed, technology and new markets. The role of extension services in this scenario will be to facilitate progression to small scale enterprises with the capability of servicing local markets or emerging market value-chains. Value-chain progression should be among the core drivers for effective extension services (Figure 5).
The growth and expansion of aquaculture business in Africa depends on the development and progression of strong and efficient value-chains. Aquaculture extension services can therefore no longer be limited to fish husbandry alone. They must address all facets of the value-chain right from natural resource use and management, fish production, the production and utilisation of inputs (notably feed and seed), processing and value-addition, marketing and much more. The scaffolding that supports a value chain is built around skills, knowledge, information and opportunity. The opportunity for aquaculture business in Africa already exits. The importance of skills, technology and know-how cannot be overemphasised. Africa’s
emerging aquaculture value-chains can only be optimised through the application of sound and relevant knowledge to harness opportunity provided for within its local and regional markets; global markets notwithstanding. The scope of extension services should expand accordingly to provide the knowledge and skill sets necessary to service and advance the emerging value-chains (Figure 6 and appendices 1, 2 and 3).

Effective extension services should cover the regionalisation and globalisation of aquaculture value chains. The expansion and diversification of market-oriented value-chains in turn, also hinges upon access to knowledge and information on opportunities. For this reason, this guideline advocates that basic in-country value chains be systematically expanded and linked through dedicated extension services to regional markets. This will entail the harmonisation of extension services within RECs to ensure aquaculture products and services are mobile within these markets.

Globally, new advancements and technologies are continuously being developed for aquaculture. In line with this paradigm shift, new technology should be adapted as appropriate through integrated extension services to suit local conditions and needs.
Extension services should not be limited to primary producers, but should be provided to all value chain players, politicians, government institutions, financial institutions and academia. Politicians should be guided not to create unrealistic expectations around aquaculture development, while financial institutions need to be exposed to the intricacies and unique risks of the various aquaculture business models that span the sector. Academia on the other hand, need be oriented towards generating more relevant outcome-based knowledge rather than purely academic research information for the sector.

3. **Elements of Effective Extension Services**

It is impossible within the context of this guideline to provide detailed content for all extension services. Aquaculture value-chains are highly varied and specific extension needs therefore differ between countries, projects, species, operators and markets. The guideline therefore advocates that prior to instituting an extension delivery system, extension service providers undertake initial sector and value-chain analyses to determine the vital area(s) for which extension services are required. As a general rule, new entrants and small-scale aquaculture operators depend more on the transfer of relevant skills, while existing operators, medium and large-scale aquaculture enterprises often seek more knowledge based resources.

Extension, extension materials for primary producers should therefore include aspects such as:

- The resources and supporting environmental services upon which aquaculture operations depend.
- Identifying and developing aquaculture opportunities.
- Establishing, managing and evaluating performance of aquaculture production systems.
- Basic husbandry practices of the relevant farmed species.
- Measuring, interpretation and management of production parameters.
- Seed supply, hatchery techniques, raising young and caring for brood stock.
- Feed supply, feed application and assessment of feed performance.
- Fish health management and biosecurity.
- Processing, value-addition, product quality and food safety.
- Marketing, meeting market standards, product handling during shipment to market for live and processed aquaculture products.
- Business planning and operating aquaculture as a business, value-chain analysis and progression.
4. **Identifying and Upskilling Extension Officers**

Historically, the majority of aquaculture extension officers in Africa were government officials with background knowledge in either livestock, crop production or fisheries. Most had little practical knowledge, skills and experience in aquaculture that limited their capacity to provide effective aquaculture extension services.

The provision of effective extension services in aquaculture should not consist of the unplanned creation of government extension officer positions. Extension services should be carefully planned. Extension services tailored to meet specific needs of the identified value-chain(s) and client(s) are more effective. The effective delivery of extension services also hinges upon the skill level and capability of extension personnel to deliver. Building the competence levels of extension service providers (be they in the public or private sector) may entail long-term investments supported by public-private partnerships.

The traditional approach to the provision of extension services through extension officers is as effective as the capabilities of the personnel are as. Where competence levels are inadequate, a range of alternative extension models (see section C hereafter) can be adopted to best achieve the transfer of knowledge and skills. These include the use of existing knowledge resources in universities and training institutions, creating associations, farmer-to-farmer support such as through field days and use of media resources.

Extension services that are inclusive of business acumen and life skills have been shown to have a greater impact on uptake as compared to those that limited to husbandry alone. Extension officers must be capable of transferring these additional skills, or should be supported by those who can extend these additional skills. Hence the importance of surrounding extension officers with adequate up-to-date extension resources that include people with complementary skills, access to libraries/online journals, logistical support and skills enhancement courses.

5. **Differentiating Between Knowledge and Skills**

Knowledge can be organically developed over time, generated through new research, gained from reference knowledge resources, taught and learnt. Skills however, refer to the successful application of knowledge. It is therefore essential that skills development is integral
to aquaculture extension, and that aquaculture extension does not remain limited to the
dissemination of knowledge resources only. Knowledge without the ability to apply it through
skills is insufficient for the successful development of the aquaculture sector.

6. **The Role of Media\(^1\) and Social Media\(^2\) in Aquaculture Extension**

Social media, together with traditional media forms such as television and printed materials,
are the most influential media for aquaculture extension on the African continent. The uptake
of media and participation in social media is mostly voluntary, meaning that any person seeking
information, even people who are not fully literate, who have access to media and social
media resources can seek and accumulate information. The greatest challenge with media
and social media is that information flow is often random, overwhelming, non-specific and
uncoordinated, with little to no project specific moderation. While this freedom of access
to information is fundamental to the modern rights of all people, it has inevitably resulted
into the adoption of inappropriate aquaculture techniques and investments with a lot of
misgivings as irrelevant and/or untested methods and information are also disseminated
by the same fora. Traditional and social media focus on the transfer of information rather
than the development of essential skills. Despite these weaknesses, social media should be
embraced as among the aquaculture extension tools, given its significant and increasing impact
and reach in modern society.

\(^1\) Media refers to traditional media notably TV, radio, newspaper and magazines
\(^2\) Social Media refers to internet based Apps notably Twitter, What’s Up, Instagram, Sype, Facebook, etc.
A host of extension models can be used for aquaculture and other sectors. The suitability of the various extension models varies depending on specific local conditions, target audiences and extension goals. The following section provides a summary of the main extension models, right from basic exposure to aquaculture in schools through to advanced tertiary training. Each section contains a table illustrating the nature and rationale, the extension implementer, recipient and target audience, the appropriate extension materials as well as the strengths and weaknesses of each model.

The different extension models are not rigidly defined, and variation exists in a continuum between them and hybrid models. The models have been grouped based on whether they operate from outside (external) the aquaculture sector or from within (internal). This division has been used only for convenience and does not relate to any preference or implied grouping of models that are not complimentary.

1. Extension from Outside of the Value-Chain

Extension from outside of the aquaculture value-chain refers to extension provided by service providers who are not an integral part of the value-chain itself, but whose services and extension support the value-chain.

1.1. Exposure at School Level

Virtually no school curricula in Africa contain any reference to aquaculture, even in schools that teach technical subjects such as, agriculture or related subjects. Where students wish to venture into the field of traditional agriculture, several primary and secondary school syllabii including tertiary institutions provide training in livestock and crop farming, but not in aquaculture. If Africa is to develop aquaculture entrepreneurs, exposure at school level even in its most basic form, is important.
### 1.2. Tertiary Institutions - Formal Programmes

Several universities in Africa have run formal programmes in fisheries science for decades. Of recent, more universities have begun to introduce aquaculture. Continentally, aquaculture courses are offered as a standalone subject, sub-modules of agricultural planning, livestock production, natural resource management or agricultural economics and in a few cases, as an independent whole qualification. For Africa to attain its full aquaculture production potential, more universities and tertiary institutions need to introduce formal aquaculture training. Given that aquaculture knowledge is relatively more accessible from a wider range of resources (including from distance learning); it is of vital importance that more skill-based programmes are developed and given at tertiary level.
1.3. Tertiary Institutions - Direct Sector Extension

The previous section dealt with formal training programmes at tertiary institutions. These institutions can also play a direct role in providing aquaculture extension services. Once universities and training institutions have introduced formal training in aquaculture, the knowledge base and human resources are generally available for the provision of extension services, provided these services are appropriately moderated of the targeted sector practitioners.

<table>
<thead>
<tr>
<th>Nature and Rationale</th>
<th>Implementer or Information Generator</th>
<th>Target Audience</th>
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<tr>
<td>• Tertiary training institutions can provide extension services to the aquaculture sector.</td>
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<tr>
<td>• Training in aquaculture should not be limited to theory, but should extend to practical skills.</td>
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<tr>
<td>• Extension services can support and inform academic programmes and research direction.</td>
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<tr>
<td>• All tertiary training institutions.</td>
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<tr>
<td>• Tertiary training institutions should seek support and guidance from Government and other sector stakeholders.</td>
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<td>• Sector practitioners – new and existing.</td>
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<tr>
<th>Main Extension Materials</th>
<th>Advantages / Strengths</th>
<th>Constraints / Weaknesses</th>
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<tr>
<td>• Short courses</td>
<td></td>
<td></td>
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<tr>
<td>• Demonstration farms and facilities</td>
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<td></td>
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<tr>
<td>• Farm visits</td>
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<td></td>
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<tr>
<td>• Linkage between the academic environment and the sector.</td>
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<tr>
<td>• Practical application of theory and research.</td>
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<td></td>
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<tr>
<td>• Research needs are better identified from the sector.</td>
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<tr>
<td>• Sector is infused with knowledge resources, including of newly approaches.</td>
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<td></td>
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<tr>
<td>• Capacity of teachers</td>
<td></td>
<td></td>
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<tr>
<td>• Shortage of funding for universities and other tertiary training institution to extend to the sector.</td>
<td></td>
<td></td>
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<tr>
<td>• Can be very academic and theory based as opposed to being practical.</td>
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<table>
<thead>
<tr>
<th>Advantages / Strengths</th>
<th>Constraints / Weaknesses</th>
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<tbody>
<tr>
<td>• An array of training materials and aides for theoretical and practical training of aquaculture subjects.</td>
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<tr>
<td>• A standalone aquaculture module that could run for one or multiple semesters depending on the scope and depth of content inclusive of entrepreneurship and agri-bussiness.</td>
<td></td>
</tr>
<tr>
<td>• A dedicated aquaculture qualification which should consist of a range of aquaculture modules. In addition to core aquaculture subjects covering husbandry systems, hatchery practices, species, resources utilisation and so on, modules in agriculture/aquaculture economics, planning and marketing should be included as among the core subjects.</td>
<td></td>
</tr>
<tr>
<td>• Capacity of teachers</td>
<td></td>
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<tr>
<td>• Shortage of expert advisors</td>
<td></td>
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<tr>
<td>• Inadequate funding</td>
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<tr>
<td>• Inadequate skills training</td>
<td></td>
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<tr>
<td>• Shortage of projects that can employ qualified aquaculture professionals</td>
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### 1.4. Vocational Training

Vocational training involves the teaching of students directly in the operation, development and management of aquaculture value-chain segments, without resorting to formal academic programmes as is the case with universities. Vocational training involves learning through direct experience in the elements of the sector, and delivers human resources that are ready to operate in the aquaculture value-chain.

| Nature and Rationale | • Training colleges tailored to provide dedicated hands-on training in aquaculture and aquaculture value-chain elements.  
• Such training equips learners with practical knowledge and skills that enables them operate and manage aquaculture units more competently and without direct supervision as opposed to unskilled personnel. |
| Implementer or Information Generator | • Vocational training colleges.  
• Government and private-sector (farm owners and value-chain role players such as suppliers and service providers that can take in students). |
| Target Audience | • Sector participants – new and existing. Preference should be given to students seeking a long-term career in aquaculture. |
| Main Extension Materials | • Dedicated aquaculture vocational training programme that can last between a few months and up to three years, depending on the degree of specialisation and time spent working on farms and in other value-chain components for practical experience  
• Internship programs. |
| Advantages / Strengths | • Delivers sector-ready skilled human resources.  
• Provides career opportunities and results in a sector with a high degree of professionalism. |
| Constraints / Weaknesses | • Few colleges and institutions that can offer vocational training  
• Capacity of teachers  
• Shortage of funding  
• Requires careful alignment with sector needs  
• Need strong relationships with commercial farms and other value-chain role players where students can receive practical training and work experience. |

### 1.5. Trainer of Trainer Model

The post-secondary models discussed above can serve as “trainer of trainer” platforms, as all trainers educators also need additional tertiary and vocational training to sustain and/or advance their competence. However, it should be noted that trainers range from a willing person in a rural community that wants to transfer aquaculture knowledge and skills through to a highly qualified full-time teacher in a formal institution.
Nature and Rationale
- Training of trainers 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
- Government, universities, training institutions, private-sector and more.

Target Audience
- Varies depending on the targeted trainer and training objectives. It could include almost any person willing to learn about aquaculture formally or informally.

Main Extension Materials
- Up-to-date knowledge and information on the topical opportunities and issues of the value-chain.
- The teaching materials can be varied according to the teaching situation, target audience and their needs. Training materials would include manuals, audio-visual aids, practical demonstrations and more.

Advantages / Strengths
- Delivers information to a broad range of people.
- Trainers need not be formally educated, provided they can transfer information and skills.

Constraints / Weaknesses
- Capacity of trainers to impart practical knowledge and skills to trainees
- Care must be taken to prevent generalisation, which could be a hurdle in understanding technical matters.

1.6. Government Officer to Farmer Model

The traditional model of aquaculture extension in Africa consisted of a Government official that was appointed to provide extension services. In many instances most had only a rudimentary background in aquaculture, and were mostly trained in traditional crop, livestock farming and fisheries. Nevertheless, this model can still be an effective means of disseminating knowledge and skills provided the extension officer is competent.

It is imperative that Governments take a value-chain approach to identify extension needs in the aquaculture sector, before determining the type of qualifications and qualities required from an extension officer. An extension officer in aquaculture cannot operate in isolation from other human, information and logistical resources. It is therefore of important that aquaculture extension programmes are carefully structured and executed, to ensure maximum reach and impact. Extension workers can only be effective if they have continuous access to up-to-date technical information generated by researchers and other centres of knowledge.
### Nature and Rationale

- Government official with a broad knowledge in aquaculture should reach out directly to farmers and other value-chain players – especially those in emergent, small and medium scale enterprises.
- The extension officer should be in a position to transfer new aquaculture knowledge and skills as well as evaluate their application thereof.

### Implementer or Information Generator

- Government led, but Government could involve other service entities such as tertiary institutions and non-state actors (NSAs).

### Target Audience

- 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

- 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 manuals, books, audio-visual 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

- Delivers information directly to new and existing farmers
- Relationship can be formed with farmers.
- Much opportunity to monitor and improve production

### Constraints / Weaknesses

- Capabilities of extension officers
- Specialisation and experience of extension agents.
- Logistic constraints to get to all farmers.
- Capability and resources for extension officers to provide associated life skills.

### 1.7. Centres of Excellence, Knowledge Hubs and Skills Clusters

Centres of excellence, knowledge hubs and skills clusters have been grouped together as a diverse concept through which Governments, RECs and NSA’s can devise a structure through which aquaculture knowledge and expertise is stored and accessed for sector development. There is no fixed rule around the manner in which these would function. Typically, such centers would employ one or more aquaculture experts who would be in position to access, accumulate, synthesise and disseminate local, regional and international knowledge and expertise for the benefit of aquaculture’s value-chain actors. These centres, hubs and clusters may be privately or publicly funded. They offer an opportunity for Public-Private Partnerships. RECs and regional hubs can play a role in the development, implementation, monitoring and evaluation of regional extension strategies and standards.
### Nature and Rationale
- Conglomerate of knowledge and information for the sector.
- These could be in country, regional, continental or international. They may have specific or related mandates on aquaculture development.

### Implementer or Information Generator
- Governments, RECs, development agencies or NSA.

### Target Audience
- Various target audiences depending on the mandate and nature of the centre, hub or cluster.

### Main Extension Materials
- A centre of excellence, knowledge hub or skills cluster can generate and use a wide array of extension materials. These include manuals, audio-visual aids, lectures, databases and more.
- Increasingly centres, hubs and clusters are using social media platforms as a means of communication with target audiences.

### Advantages / Strengths
- Centres, hubs and clusters can serve a wide audience with a range of information including resources.
- They tend to have strong partnerships and are better placed to access and share updated information.
- Create a platform for local and regional exchange of information and ideas.

### Constraints / Weaknesses
- Limited capability for practical skills transfer especially where information shared is limited to written materials.
- Finding experts to operate such centres, hubs and clusters can be difficult.
- When highly dependent on international knowledge and funding, their ability to provide appropriate information relevant to local production systems and conditions often becomes compromised.

### 1.8. Non-Government Organisations and Development Agencies

Closely associated with the section on aquaculture centres, hubs and clusters, is the role of NGO's and development agencies. In some instances, NGO's and development agencies act as centres, hubs and clusters (for example aquaculture technical units of AU-IBAR, NEPAD and WorldFish). For sustainable development, they are better placed as facilitators and generators of specific information flows to the aquaculture sector. For example, development of international standards as undertaken by FAO for aquaculture production and aquatic animal diseases by the OIE. These organisations and agencies can play a direct role in aquaculture extension and regional extension strategies that include the setting and evaluation of aquaculture training and extension standards.
| Nature and Rationale | • NGOs and development agencies are becoming increasingly involved in Africa's aquaculture development strategies, albeit limited direct involvement with emerging farmers and small-scale operators.  
• 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 | • Government, inter-governmental agencies, RECs, NGOs and other development partners. |
| Target Audience | • Various target audiences depending on the mandate of the agency.  
• Regional and continent-wide agencies and organisations often work with Governments as the audience for policy and program development. |
| Main Extension Materials | • An wide array of extension materials, including policy briefs, manuals, visual aids, seminars, study tours and more.  
• Social media platforms as a means of communication to target audiences. |
| Advantages / Strengths | • Can access and serve a wide audience with a range of materials.  
• Have strong international linkages.  
• Information from such agencies is generally well received by the formal aquaculture sector. |
| Constraints / Weaknesses | • Limited practical skills transfer as the largely disseminate written information.  
• Tend to be public policy focussed as opposed to enhancing practical skills of practitioners.  
• When strongly driven by international funding and extension materials, extension messages and strategies may be short on locally applicable solutions. |

### 1.9. Demonstration Projects

Demonstration projects offer good opportunities for transferring practical knowledge and skills to new entrants and existing operators for all elements of the aquaculture industry. In addition to providing an ideal training base, demonstration projects can be geared to supplying products to markets. Income generated from such projects can be ploughed back to enhance their sustainability. The benefits of such an approach include opportunities for local employment and the verification and adaptation of novel aquaculture technology prior to commercialisation.
2. **Extension from Within the Value Chain**

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

2.1. **Associations and Societies**

In all industries, the importance of sector associations and societies in providing extension services should not be under estimated. Associations and societies are often a first point of contact for new entrants and small-holder producers. Where members of associations and societies are active, information flow is most often direct, relevant, up-to-date and applicable to local conditions, species and markets.
### Nature and Rationale

- Aquaculture associations and societies are mainly member driven organisations that represent the interests of producers and other value-chain stakeholders.
- They can contribute significantly as a platform for extension services.

### Implementer or Information Generator

- Association and society members.
- Additional bullet: Complementary support from government, private-sector companies, training institutions and niche markets.

### Target Audience

- Association/society members including new entrants.

### Main Extension Materials

- Various extension methods may be used such as meetings, newsletters, web-pages, field days, shows and trade fairs, etc.

### Advantages / Strengths

- Familiar and accessible extension environment for members.
- Accessible for new farmers.
- Presence of existing members enables more effective skills and information transfer.
- Experienced knowledge-base relevant to the area, species and collective markets.
- Cost effective. Extension provision costs are often much lower when Governments or other agencies utilise associations/societies for extension.

### Constraints / Weaknesses

- 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 effectively serve members.

## 2.2. Farmer to Farmer Model

Related to the is the farmer to farmer extension. Extension from one farmer to another can take place organically, but can also be structured into a formalised extension model for certain skill sets. Fellow farmers are also ideally positioned share knowledge and lend practical assistance to other farmers and new sector entrants.
### Nature and Rationale

- Farmers with advanced experience and competence in the operation of aquaculture can transfer the required knowledge and skills to fellow farmers. This can be formalised by providing the farmers with extension materials and aids.

### Implementer or Information Generator

- Farmers.
- To use this as an extension model Government can support farmers within a formalised structure through the provision of extension materials and possibly incentives to better equip them transfer knowledge and skills to fellow farmers.

### Target Audience

- Primarily existing small-scale operators and new sector entrants.

### Implementer or Information Generator

- Mainly through one-to-one contact between farmers. Focused at the transfer of practical knowledge and skills.
- Additional supportive extension materials such as manuals and visual aids.
- Farmer run on-farm field days are a practical means of harnessing local skill and knowledge for extension.

### Advantages / Strengths

- 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, species and common markets that other farmers use.
- Information transfer is often skills centred.
- Cost effective means of extension when Governments use existing farmers to provide extension.

### Constraints / Weaknesses

- In some instances, when the information giver finds no advantage in sharing information, they may not pass the necessary information on.
- May not be up-to-date with new trends and technology where they have limited access to knowledge generators and vice versa.
- Capacity and availability of farmers to willingly teach peers can be a challenge.

### 2.3. Commercial Farmer to New Entrant / Small Scale Farmer Model

Some large-scale commercial operators have satellite farming ventures involving small-holder producers to increase their net production to meet market demand. Such programs mimic the farmer-to-farmer model and may be done voluntary as part of a company’s social-corporate responsibility, under a contractual arrangements or as part of natural resource access agreements with smallholder owners. Such arrangements open up opportunity for market-oriented private-sector led value-chain extension services. These models can additionally benefit for the transfer of practical knowledge and skills through internships and apprenticeships under formalised arrangements where the extension objective is to promote entrepreneurship.
<table>
<thead>
<tr>
<th>Nature and Rationale</th>
<th>• Commercial farmers transfer knowledge and skills through satellite out-grower or social-corporate programmes thus investing into up-grading or providing new skills to small holders, new entrants and communities.</th>
</tr>
</thead>
</table>
| Implementer or Information Generator | • Commercial Farmers.  
• To use this as an extension model, governments and other agencies can encourage and support commercial farmers to transfer knowledge and skills to small-holders. This can be considered as among the requirements for granting operating licences to large commercial and multi-national entities. |
| Target Audience | • Primarily existing small-scale operators and new sector entrants. |
| Main Extension Materials | • 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 large commercial establishments, the distribution of training materials, skills training through open days, internships, apprenticeships and more.  
• Working with large commercial farmers to present field days is a practical means of harnessing local skill and knowledge resources in extension services. |
| Advantages / Strengths | • Smallholder’s and new entrants get to develop in a commercial environment, where commercial skills for operating aquaculture as an enterprise can be transferred.  
• Small-scale satellite growers have potential access to niche and other larger markets.  
• Improve the capacity of small-holders to meet standards. Skills and technologies in a successful business are based on meeting required standards.  
• Cost effective means of extension when Governments collaborate with commercial farming entities to provide extension. |
| Constraints / Weaknesses | • Exploitation of small-scale farmers and new entrants can occur.  
• Can result in small-scale farmers not gaining full and independent access to the value-chain. |

2.4. Extension from Upstream or Downstream Value-Chain Participants

The creation of extension services through upstream and downstream value-chain participants is similar to having farmers help farmers, and to having commercial farmers empowering smallholder operators and new entrants. Fingerling suppliers and service providers. Typical among these include extension services provided to small-holders and new-entranys by feed and fingerling suppliers, equipment and other service providers as well as from end-product processors and buyers. This provides a diverse model for extension with different facets and dynamics whereby all parties inadvertently are seeking market access for the goods and
Nature and Rationale
- Up and down stream value chain participants can play a vital role in extending information to other value chain players, based upon the products and services they produce, or by sharing mutually beneficial information for all parties along the value chain.
- The incentive for value-chain participants involvement 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 products.

Implementer or Information Generator
- All value-chain participants, notably feed, fingerling and equipment suppliers, processors and buyers of aquaculture produce and products.

Target Audience
- Respective value chain players. value chain,
- Primary producers of aquaculture products that can benefit from additional or alternative technologies and methods.

Main Extension Materials
- One-to-one demonstrations shows and trade fairs, farmer days, training manuals, brochures, workshops, seminars, audio-visual aids and more.
- Where extension takes place from fingerling suppliers, farmers can be shown how to care for and grow the fingerlings.
- Where extension takes place from feed suppliers, farmers can be shown best feed usage practices, feed and growth monitoring etc.
- Where extension takes place from end product buyers, farmers can be shown how best to harvest to retain quality and more.

Advantages / Strengths
- There are usually benefits for both the information giver and receiver 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 produce.
- Cost effective means of extension when Governments collaborate with value chain participants to provide extension.

Constraints / Weaknesses
- Risk of exploitation of small-scale farmers and new entrants by larger value-chain suppliers and service providers.
- Can result in small-scale farmer not gaining full and independent access to the value-chain.
- May limit the scope and options for primary producers businesses to expand, diversify or adopt new technology within existing value-chains.
2.5. Model Farms

Although model farms have been added as an extension model within the value-chain, this assumes that the model farm is owned and operated by participants in the aquaculture value chain. Other than for this fact, model farms provide much the same extension platform as demonstration projects that were discussed in section 1.8. Such model farms offer good opportunities for the training and skills development for new entrants and existing operators who need to improve or acquire new skills in specific areas. Model farms can be run commercially whereby the extension services offered become among the establishments revenue streams.

<table>
<thead>
<tr>
<th>Nature and Rationale</th>
<th>Implementer or Information Generator</th>
<th>Target Audience</th>
<th>Constraints / Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Model farms and other aquaculture value-chain enterprises are independent entities that offer a platform for the transfer of knowledge and skills to sector participants. • This guideline views model farms as privately owned enterprises. Publicly owned model farms are considered as demonstration units (section 1.9).</td>
<td>• Owners and operators of model farms Governments and other agencies can establish a formal arrangement with these farms for the provision of extension services.</td>
<td>• New emergent farmers, and existing operators that need to acquire new or additional skills in their aquaculture business. • Aquaculture trainers extension officers, students from tertiary institutions and more.</td>
<td>• The sharing of advanced knowledge and techniques can create competition for model farms which could result in beneficiaries being given incomplete knowledge and skills. • Use of model farms to provide formal extension services can be expensive for Governments, unless private entities operate the service as a business practice.</td>
</tr>
<tr>
<td>Main Extension Materials</td>
<td></td>
<td></td>
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<tr>
<td>• Hands-on practical training to obtain practical knowledge and skills complemented by manuals, workshops and audio-visual aids. • Model farms can also offer extension through formal programmes, satellite farming programmes and more.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Advantages / Strengths</td>
<td>Constraints / Weaknesses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Hands-on development of farming skills. • Skills are relevant to the locality and species farmed in that locality. • Can also serve as a research and training facility while producing aquaculture goods for sale. • Extension services can be a source of income for the farm.</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
2.6. **Internships**

Closely related to model farms is the provision of extension through internships. Extension by internship consists of individuals taking up paid or unpaid position in an existing aquaculture facility over a period of time to acquire practical experience. Equipping career seekers, new and existing value chain participants through such opportunities is ideal as the intern, by working closely with the facility personnel benefits from mentorship and acquires practical skills and working knowledge within an operational environment. Aquaculture internships are hard to come by and existing commercial aquaculture establishments do not readily offer such positions of learning.

<table>
<thead>
<tr>
<th>Nature and Rationale</th>
<th>Implementer or Information Generator</th>
<th>Target Audience</th>
</tr>
</thead>
<tbody>
<tr>
<td>An internship consists of taking up employment (paid or unpaid) in an operational</td>
<td>Owners and operators of existing</td>
<td>Those wishing to make a career of aquaculture, and entrepreneurs.</td>
</tr>
<tr>
<td>aquaculture establishment or value-chain component.</td>
<td>aquaculture facilities. The provision</td>
<td>• Existing farmers and new entrants.</td>
</tr>
<tr>
<td>Internships provide hands-on training opportunity for the development of practical</td>
<td>of internships could be encouraged</td>
<td></td>
</tr>
<tr>
<td>knowledge and skills within an operational environment</td>
<td>by Governments through incentives</td>
<td></td>
</tr>
<tr>
<td></td>
<td>and as conditions in operating</td>
<td></td>
</tr>
<tr>
<td></td>
<td>licences.</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Main Extension Materials</th>
<th>Advantages / Strengths</th>
<th>Constraints / Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primarily hands-on practical experience and mentorship in the workplace.</td>
<td>On-site practical acquisition of knowledge and skills</td>
<td>Internships are rare.</td>
</tr>
<tr>
<td></td>
<td>Skills are relevant to the area, species and market supplied by the establishment.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Employment can be provided in tandem with an opportunity to develop knowledge and skills.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Commercial operators could train future employees in this manner.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Internships often lead to further employment and an internalisation of skills and knowledge, as opposed to new trainees creating new ventures.</td>
<td></td>
</tr>
</tbody>
</table>
3. **Social Media Based Models**

Social media, as a means of providing aquaculture extension, is discussed separately because it sits neither within nor outside of the aquaculture value-chain. Social media arguably offers the greatest opportunity to revolutionise extension services for aquaculture on the African continent. Even though the majority of African citizens still have no access to social media platforms, the younger generation has embraced social media and Africa is rapidly becoming “connected”. Access to personal computers is becoming less important, as access to information via portable and less expensive mobile phones is becoming the norm.

Social media ranges from electronic access textbooks and manuals, videos, articles, aquaculture news, stories, advertisement from service providers and product buyers, and much more. Increasingly, both public and private institutions are using social media platforms to communicate to their target audiences. Several aquaculture societies, associations and training institutions operate websites and freely communicate through Facebook, Twitter, Instagram, YouTube and other platforms. Examples of social media platforms that cover African aquaculture include the Sustainable Aquaculture Research Networks in Sub Saharan Africa (SARNISSA - [www.sarnissa.org](http://www.sarnissa.org)) and the Aquaculture Africa Magazine (AAM – [www.aquaafricamag.com](http://www.aquaafricamag.com)).

| Nature and Rationale | • Social media encompass 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 network.  
| | • Aquaculture information is readily available on social media platforms across Africa, specifically to people that have access to internet.  

| Implementer or Information Generator | • Every 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 | • Every person that has access to social media.  
| | • In aquaculture this includes new entrants and existing farmers, and other value chain players.  

| Main Extension Materials | • Website and applications that are accessed mainly through the internet.  
| | • Highly varied materials that include electronic manuals, news, video feed, blogs, website articles and more.  

28  *African Union – Inter-African Bureau for Animal Resources*
### Advantages / Strengths
- 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 enhances interaction between target audience and generator irrespective of geographical distance.
- Opportunity for ‘real-time’ exchange of information/communication.
- Both literal and practical knowledge (i.e. audiovisual options) can be disseminated.

### Constraints / Weaknesses
- 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 those without experience in aquaculture. Moderation of information is difficult.

### Advantages / Strengths
- Employment can be provided in tandem with an opportunity to develop knowledge and skills.
- Commercial operators can extend training to future employees using social media.
A Snap of Aquaculture Extension in Africa

School children being exposed to the concept of aquaculture

Is that how they look like??!!! Farm tours for school children to fish farms in Nigeria. Pictures courtesy of Anthony A. Nlewadim, Michael Okpara University of Agriculture, Nigeria

Amazed at seeing fish alive!!!!. School children at an aquaculture trade fair in South Africa. Pictures courtesy of Etienne Hinrischen, AquaEco, South Africa

Practical on-farm demonstrations

Universities provide skills training to producers on key aspects across the value-chain. Aquaculture producers undergoing a class demonstration, visit to a commercial fish feed mill and on processing farmed trout to add-value in South Africa. Picture Courtesy of Henk Stander, Stellenbosch University, South Africa
Practical on-farm demonstrations

On-farm training and demonstrations, Egypt. Picture courtesy of Patrik Hendriksen et al, WorldFish, Egypt.

Seminars and Symposia

Pond construction training for farmers. Picture courtesy of Nazael Madala, Sokoine University, Tanzania

Farmers in a class session. Picture courtesy of Nazael Madala, Sokoine University, Tanzania

Farmers on a study tour to another farm. Picture courtesy of Ben Kiddu, WAFICOS, Uganda

Information Exchange and Dissemination

Several aquaculture magazines are available that are now produced by African private sector and farmer associations. The Aquaculture Africa Magazine, is the first continental aquaculture magazine (online: www.aquaafricamag.com). Picture courtesy of Etienne Hinrichsen, AAM, South Africa

Farmer organized symposia and trade fairs. Picture courtesy of Ben Kiddu, WAFICOS, Uganda.
Aquaculture information on my smart-phone. This AgroMarket Day mobile App is an initiative by WAFICOS farmers supported by AquaCRSP and NaFIRRI to reduce costs and ease access to information. The App provides extension material, enables farmers access markets and inputs, etc. (Picture courtesy of Isaac Omiat, AgroMarketDay, Uganda) https://play.google.com/store/apps/details?id=com.agromarketday

SARNISSA is an internet based aquaculture information exchange platform with wide coverage in Africa (online www.sarnissa.org). Picture courtesy of SARNISSA.
SECTION D: TEN BEST PRACTICES IN EXTENSION SERVICES

1. Understanding Language, Cultural and Educational Constraints

Within literally all African countries, there are vast differences in languages and cultures. Likewise, so are the differences in educational background either due to different opportunities, systems of education and many other factors. For extension services in aquaculture to be successful, these language, cultural and education barriers need to be understood, embraced and used to shape extension materials and the means of extension. Materials should be prepared in the languages of the target audience and, where possible, presented by people of the same culture or who have a full understanding of the cultural and local socio-economic challenges that exist. Extension materials for new entrants into the aquaculture sector should be simple, clear, interesting, practical and easy to understand. In all instances, extension services should be in line with the continental policy objectives to become market-oriented, innovative and entrepreneurial in nature and conscious of environmental sustainability.

2. Aquaculture Relies on a Diverse Basket of Skills

As illustrated earlier, success in aquaculture is not just about growing fish. An aquaculture business lies within a value chain that consists of various elements, each of which requires knowledge and skills. It is for this reason that extension services and materials should reach beyond just the growing of fish. Extension services should include other elements of the value chain, such as fingerling and feed supply, harvesting, processing, distribution, marketing, business skills and aquatic environmental management. The transfer of knowledge and skills through extension services should equip new entrants and existing farmers with all the elements they require to operate a successful aquaculture venture, including knowledge and skills outside of the farming environment on the running of a business, human resource management, natural resource management and more.
3. **Always Peruse Relevance**

Extension services should always be relevant to the species and systems that are feasible and viable in the area in which the extension services are provided. Globally, there is a wealth of information freely available on the operation of aquaculture. However, not all this information is relevant to African conditions, nor the farming or business environment in its specific regions. For this reason, extension materials should speak to local conditions, resources, species, markets and other relevant factors that locally influence aquaculture.

4. **Keep Information Up to Date**

Aquaculture extension and information services should work to deliver the relevant knowledge and skills in concurrence with the sectors prevailing requirements. This necessitates that the information from which knowledge and skills are derived remains up-to-date. Furthermore, aquaculture information and technological is rapidly advancing worldwide. Africa should not allow itself to be burdened by outdated and less efficient means of aquatic farming. To keep abreast, field experts and producers should be consulted at all times, in the development of extension materials. Where appropriate, intra-regional and international collaborations should be pursued, and such materials should be reviewed regularly.

5. **Embrace Local and Indigenous Knowledge**

Despite the importance and relevance of some international technologies and knowhow (see above), many African countries have been involved in the fisheries of local species for millennia. This means that certain skill sets have developed locally, and these should be embraced in the development of aquaculture on the continent. Of equal importance is that markets for fish in Africa have preference for specific local products. Aquaculture and aquaculture related enterprises can benefit significantly from tapping into these local knowledge resources.

6. **Turn Knowledge into Skills**

Knowledge alone will not result in aquaculture success. For aquaculture to succeed, knowledge must be transformed into skills. Globally, much aquaculture knowledge is available that can be incorporated as appropriate into extension material for use on the continent. Recipients of such knowledge must be taught how to apply it appropriately within the local context.
(socio-economic opportunities and environmental sustainability notwithstanding) of their enterprises. Recipients must therefore be given the necessary supporting information to enable them transform knowledge resources into practical skills for application.

Differentiation must be drawn between the level of knowledge resources and skills that are required at different levels of extension. As a general rule, new entrants and small-scale farmers tend to derive greater benefit from hands-on skills training, while established and larger commercial scale aquaculture ventures tend to gain greater benefits from knowledge resources that are applied within existing skills frameworks.

7. **Create Self-sufficiency and Entrepreneurship**

Long-term growth and development of aquaculture in Africa depends on the creation of independent entrepreneurs. Extension services are essential in equipping new entrants, training young people and bringing new knowledge and skills into the sector. However, they must be trained with the view to creating self-sufficiency. Extension services are not about continuously training the same people with the same or similar skills. Aquaculture extension services should aim at equipping the sector players become competent and capable enough to start up aquaculture ventures, and to take up employment in these and other aquaculture businesses. These new businesses should be liberally supported to ensure they succeed and thereafter move towards independence and self-sufficiency, later becoming training grounds for new entrants into aquaculture.

8. **Remain Market Orientated**

Extension services must be built producing a product that can be sold at a profit. Extension services need therefore remain market focussed. Extension content should therefore reflect the importance of market creation, market access and serving markets competitively. Aspects such as consistency of supply, product diversification, value addition, product quality and food safety need therefore be part of the extension package.
9. **Seek Innovation**

By virtue of its nature, aquaculture advancement depends on innovation. Several aquaculture extension programmes in Africa have become out-dated contain out-dated information that is often no longer relevant to the contemporary production techniques and markets trends. Information on innovations in farming techniques, species, markets and enterprise viability need to be reviewed regularly to update extension material. Regular reviews and updates need be collectively obtained and synthesised by from sector specialists, producers and targeted markets. Aquaculture techniques are developing rapidly, and for Africa to become a globally significant aquaculture producer, these techniques must be evaluated and adapted with local knowhow and innovation.

Where possible, new species and farming techniques, feeds, harvesting techniques, products and business models for aquaculture should be tried and tested initially through public institutions, to ensure local viability prior to dissemination.

10. **Incorporate Resource Protection**

A conducive environment for aquaculture entails productive natural resource-base for the supply of adequate water of the appropriate quality, key inputs (notably feed and seed) and land for production premises. The sustainable use and protection of these resources, their biodiversity and biosecurity must be among the cornerstones of any aquaculture extension programme. Beneficiaries of aquaculture extension programs should be brought to appreciate the linkage between long-term business viability and the sustainable use and management of aquatic resources. Viability here includes external factors like markets, technology change and changes in consumer tastes and preferences.
SECTION E: CROSSCUTTING ISSUES

This guideline has dealt extensively with aquaculture extension, the various models that can be used for extension in African aquaculture and the best practices for extension. Yet, several other issues simultaneously affect the status and progress of aquaculture development in Africa. These crosscutting issues need to be concurrently addressed (including within the realm of extension) for the continental aquaculture development goals to be achieved.

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 through media, and for whom the tools and opportunities to participate in the mainstream economy are 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, and contribute as the core workforce in the present and future. The long-term sustainability of aquaculture as an activity, depends on the active participation of the youth.

2. Social Responsibility and Occupational Safety

Commercial and large-scale aquaculture tends to become self-sufficient in terms of value chain progression. This is however not typically the case for subsistence, small-scale aquaculture and marginalised communities whose livelihood strategies are often directly linked to practices that entail labour sending and direct natural resource exploitation. These marginalised communities often suffer from extreme poverty, high levels of illiteracy, food insecurity and are more exposed to social ills. For a successful paradigm shift, these role-players must be empowered to participate effectively and proficiently in the sector.

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3 The potential labour force in rural areas is often marginalized and consequently becomes driven to migrate to areas with better opportunities, which constrains local subsistence and small-scale aquaculture progression.
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 them to engage in projects oriented towards generating profit, regardless of how small, has proven to be a more beneficial and sustainable option than subsidised aquaculture development.

At all times, the occupational safety and health of aquaculture workers needs to be safeguarded. Information on occupational risks and mitigation measures need be provided in extension programs and displayed in facilities. The major occupational risks are physical injuries associated with working around water and at night. Injuries arising from slips and falls including drowning are common. In compliance to labour laws the workplace should be safe and employees should be treated with adequate dignity in accordance to their rights. Hence:

• Under all circumstances employee rights must be upheld.
• All aquaculture infrastructure and facilities must be designed and constructed to meet relevant structural standards following engineering specifications to ensure worker safety. Attention must be paid to the integrity of pond and dam walls, water channels, tanks, walk and drive-ways, piers as well as electrical installations for wet operational environments. Adequate drainage must be provided to prevent the dangers arising from working in deep water or mud.
• The necessary safety equipment (such as life jackets), training in their use and on required emergency responses (such as the measures that should be applied when a person is drowning) must be a component of extension information.
• Likewise, adequate and appropriate protective clothing and gear must be provided for the various operational tasks such when handling of chemicals, working on floating cages, etc.
• 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 keep personal 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 occupational safety and other skills.
• Pursuant to gender equality, employment opportunities in aquaculture must be made available to men and women, based upon their competencies and capabilities.
• Although opportunities should be created in the sector for youth, child labour is not acceptable.
3. Environmental Matters

Given the close-knit between aquaculture and environmental resources (land, water, feed and stock), environmental challenges often have a direct impact on the performance and sustainability of aquaculture. Well-planned mitigation strategies against environmental fluctuations such as water shortages, pollution and flooding must be accounted for and articulated within extension packages.

Aquaculture extension packages should also provide information to enable producers mitigate against potential negative impacts of their operations on the environment. Major environmental risks from aquaculture include water pollution arising from poor feed regimens, chemicals, poor effluent management and the loss of and/or introgression of aquatic biodiversity.

In modern-day aquaculture, the use of exotic species poses biodiversity risks. The use of GMO species and inputs. African aquaculture sector. Respect for international and continental standards on biodiversity need be respected, and for this to happen, sector stakeholders need to be well informed. Where permitted, production of exotic species should be within the framework of local environmental and aquaculture regulations. Responsible use of aquatic genetic bio-diversity encompassing the implementation of the recommended mitigation measures applies to the production of all species and production systems.

The tools that can be used to improve the development and management for 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, as well as to sustainably manage increasingly limited natural resources. Although these may not be essential to the development of small scale or rural aquaculture, the paradigm shift to sustainable market-oriented aquaculture development in Africa depends on the implementation of these globally important standards. These issues need therefore be articulated within extension packages.
4. **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 and transparency. Good governance follows the rule of law and encompasses the principles of responsiveness, equitable and all-inclusive participation, consensus effectivity and efficiency.

5. **Climate Change**

Climate change has become a global phenomenon, which is increasingly impacting human activities such as agriculture because of its impacts on the natural resources (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 developments in less affected or alternative areas, investment into 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. Awareness, knowledge and skills to support climate change adaptation and mitigation need be built and disseminated to aquaculture practitioners.
SECTION F: CONCLUSION

1. Cross Section of an Ideal Aquaculture Extension Service Model for Africa

There is no single recipe for success in aquaculture extension for Africa, but rather a combination of aspects that needs 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 extension service, include:

- Aquaculture extension should be aligned to the ever-improving policy environment for the sector, but should remain focussed on equipping people with the knowledge and skills to operate aquaculture businesses independently.
- Extension materials and methods should remain relevant, up-to-date and innovative.
- Knowledge should be developed into the required skills as appropriate.
- Extension services much seek the development of aquaculture entrepreneurship.
- Extension services should cover the entire aquaculture value chain from inputs and services, through production to market development, taking into account environmental sustainability and biosecurity.
- Extension services should facilitate the aquaculture value chain progression.
- Suitable extension models should be selected based on the assessed needs of the beneficiaries, taking into consideration language, culture and level of education.
- Social media should increasingly be harnessed for the provision of extension.

2. Dissemination and Implementation

The institutional arrangements for application of the extension principles in this guideline involves adoption of the document by by all stakeholders of the value chain including RECs, Member States and NSAs. To ensure that the principles herein inform policy and strategy for aquaculture development across Africa.

3. Closing Remarks and Commitment

This guideline around best practices to support effective extension services for African aquaculture seeks to support the paradigm shift that is required to ensure that aquaculture can develop to its full potential and contribute tangible 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, with a concerted collaborative effort to establish aquaculture as a significant contributor of Africa’s socio-economic development.
REFERENCES


APPENDIXES

Appendix 1: Mapping Value Chains

Key for figures below:

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

DEVELOPMENT STAGE 1: 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)

<table>
<thead>
<tr>
<th>Development Criteria</th>
<th>Subsistence Level</th>
<th>Emerging Fish Farmer Level</th>
<th>Start Up Commercial Fish Farmers</th>
<th>Developing Commercial Fish Farmers</th>
<th>Aquaculture Industry</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Quality Fish Farm Design &amp; Construction</td>
<td>None</td>
<td>None</td>
<td>Limited based upon visits to other farms/ facilities with incomplete or poor designs</td>
<td>Development of core group of commercially viable producers and poor copycats; Design by academia or government support</td>
<td>Establishment of specialized services by private sector-Engineering, design and construction services</td>
</tr>
<tr>
<td>2. Quality &amp; Quantities of Feeds</td>
<td>Compost or supplemental feeds (Ag/ household wastes)</td>
<td>Supplemental or on-farm feed production</td>
<td>Limited access, incomplete on-farm produced sinking feeds</td>
<td>Development of nutritionally complete pelleted feeds with increased access, but limited understanding of feed application and its economics</td>
<td>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.</td>
</tr>
<tr>
<td>3. Quality &amp; Quantities of Fish Seed from Hatcheries</td>
<td>Irregular; limited availability; Usually natural pond production or government supplied</td>
<td>Government supplies seed; Limited hatchery design; Limited artificial spawning techniques</td>
<td>Improved Hatchery Design with Aeration; Use of Artificial Spawning Techniques</td>
<td>Increased use of artificial spawning with greater production intensity through improved aeration/ water quality management</td>
<td>Variety of spawning techniques available and implementation of quality control management plans; Fingerling producers become specialized and foodfish producers purchase fingerlings from hatcheries.</td>
</tr>
<tr>
<td>4. Record Keeping (Inventory &amp; Budgets)</td>
<td>None</td>
<td>None or little; mostly in journal format.</td>
<td>Awareness and Started</td>
<td>Greater need as intensity and required inputs increase. Records used to make management decisions.</td>
<td>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</td>
</tr>
<tr>
<td>Development Criteria</td>
<td>Subsistence Level</td>
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</tr>
<tr>
<td>5. Water Quality Monitoring &amp; Management</td>
<td>None</td>
<td>None; Limited flushing for control</td>
<td>Awareness but no equipment</td>
<td>Water Quality Monitoring &amp; Management increases requiring increased access to equipment</td>
<td>Widespread use of water quality monitoring for intensive farm management and environmental/ marketing requirements.</td>
</tr>
<tr>
<td>6. Understanding of Holding &amp; Transport Live Fish</td>
<td>None</td>
<td>None to poor</td>
<td>Awareness but no equipment</td>
<td>Increased need for holding and transporting fingerlings and food fish; Introduction of specialized methods and equipment</td>
<td>Specialized private-sector services for harvesting, transporting and live holding for markets</td>
</tr>
<tr>
<td>7. Fish Farm Production Management Plans</td>
<td>None</td>
<td>None to Limited</td>
<td>Awareness</td>
<td>Limited numbers of technical packages available for farmers for field implementation and testing</td>
<td>Widespread use of field-proven technical packets with development of additional systems/species by academia/ government</td>
</tr>
<tr>
<td>8. Fish Health Management</td>
<td>None; disease outbreaks limited or not recognized</td>
<td>None; disease outbreaks limited or not recognized</td>
<td>Awareness due to increased outbreaks, but limited planning</td>
<td>Limited development of support services and limited understanding of management relationship to disease occurrence</td>
<td>Widespread use and private and public service providers available for on-farm management advising plus developed disease diagnostic services</td>
</tr>
<tr>
<td>9. Quality Training in Aquaculture</td>
<td>None</td>
<td>Limited training by NGOs and local government</td>
<td>Limited Government &amp; Academic Delivery</td>
<td>Training emphasis provided in hands-on, commercial-scale production by NGO/academia</td>
<td>Level of training increases to strengthen technical knowledge and provided by academia and on-farm experience</td>
</tr>
<tr>
<td>10. Availability of Trained Farm Staff</td>
<td>None</td>
<td>None</td>
<td>Very limited; mostly theoretical training</td>
<td>Increasing in number and quality but still limited</td>
<td>Widely available with practical knowledge &amp; highly competitive (i.e., higher pay)</td>
</tr>
<tr>
<td>11. Quality Advisory Services</td>
<td>None</td>
<td>Limited Extension Services by Government</td>
<td>Limited Extension Services (i.e., NAADS), but no certification of qualifications</td>
<td>Quality increasing but still mostly farm based support (farmer to farmer transfer)</td>
<td>Network of Service Providers with certification</td>
</tr>
<tr>
<td>Development Criteria</td>
<td>Subsistence Level</td>
<td>Emerging Fish Farmer Level</td>
<td>Start Up Commercial Fish Farmers</td>
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<tr>
<td>12. Equipment &amp; Suppliers/Tech Support Capacity</td>
<td>None</td>
<td>None</td>
<td>Self-served by farmers or NGO-driven</td>
<td>Very few with some farmer cooperatives forming to facilitate purchasing</td>
<td>Network of Suppliers with technical back-stopping</td>
</tr>
<tr>
<td>13. AQ Regulations &amp; Laws</td>
<td>None or Limited</td>
<td>None or Limited</td>
<td>Developing but often conflicting</td>
<td>Understood need to develop and harmonize</td>
<td>Need to facilitate industry development but set reasonable limits</td>
</tr>
<tr>
<td>14. Markets</td>
<td>Mostly household consumption</td>
<td>Mostly household use and pond bank sales</td>
<td>Local sales</td>
<td>Local sales (retail) with expanding wholesale market</td>
<td>Range in retail and wholesale markets with regional distributors and exporters</td>
</tr>
</tbody>
</table>
Appendix 3: Extension Framework and guideline for extension Model

1. The status of the aquaculture industry differs in the different countries.
2. Farmers are at different levels in the different countries therefore have different needs.
3. Appropriate extension interventions and recommendations will therefore differ accordingly for the different MS.

The table below that summarises an assessment of extension needs in view the objectives of the PFRS. It is summarised as follows:

1. Characteristics at each level of development.
2. Extension needs at each level of development versus the expected outcomes from these extension services.
3. Roles of both the private and public sector in extension delivery at each level of development with reference to appendix 2 above.

<table>
<thead>
<tr>
<th>Progression of the Aquaculture Sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development Criteria</td>
</tr>
<tr>
<td>---------------------------------------</td>
</tr>
<tr>
<td>1. Characteristic at each level of development</td>
</tr>
<tr>
<td>Nature of Enterprise (types of ownership)</td>
</tr>
<tr>
<td></td>
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<td></td>
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<td></td>
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<tr>
<td>Producer Production Objective/ Markets</td>
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<td></td>
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<tr>
<td>Operational Features</td>
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</tbody>
</table>

African Union – Inter-African Bureau for Animal Resources
### Progression of the Aquaculture Sector

<table>
<thead>
<tr>
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<tbody>
<tr>
<td></td>
<td>- Seeks best quality inputs, constraint costs. Ability to purchase often not consistent</td>
<td>- May have a simple business plan - Farms becoming more specialised - Emergence of production value-chains</td>
<td>- Several of value-chain elements operating as independent small businesses.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farmers Groups/ Associations</td>
<td>- Farmers groups that function as self-help groups - Limited capability for financial contributions</td>
<td>- Can make some financial contributions to advance their interests</td>
<td>- Emergence of producer associations with membership subscription - Associations may include other actors from the emerging value-chains - Emergence of specialised associations (e.g. species)</td>
<td>- Commercial producers associations run on membership subscriptions and managed by hired professionals - More specialised associations - Emergence of commodity based associations (e.g. by species, hatchery/grow-out, etc.) - Associations better able to independently articulate, negotiate and advance members interests - association may have business plan - better quality services to members (e.g marketing, extension,</td>
<td>- More professionally run and managed sector and producer associations financed by returns from membership subscription and provision of services - Associations with business and operations plans - Association capable of making investments to promote the interests of their members</td>
</tr>
</tbody>
</table>

### 2. Extension Needs

1. Increase production and productivity

- Optimise utilisation of available resources
- Introduction to more productive technologies accessible to them
- BMPs

- Application of appropriate improved technologies
- BMPs for all aspects of production

- Application of appropriate improved technologies including for emerging segments of value-chain
- BMPs for all aspects of emerging value-chain

- Application of appropriate improved technologies including for emerging segments of value-chain
- BMPs for all aspects of emerging value-chain

- Application of appropriate improved technologies including for emerging segments of value-chain
- BMPs for all aspects of emerging value-chain
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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Infrastructure development (e.g. ADS, energy, bulk water harnessing, etc.)</td>
<td>- Veterinary and engineering services</td>
<td>- Infrastructure development (e.g. ADS, energy, bulk water harnessing, etc.)</td>
</tr>
<tr>
<td>2. Increase incomes and employment opportunities</td>
<td>- Leverage to SMEs</td>
<td>- Leverage to SMEs and MSEs</td>
<td>- Strengthen producer SMEs and MSEs</td>
<td>- Strengthen producer SMEs and MSEs</td>
<td>- Strengthen producer SMEs and MSEs</td>
</tr>
<tr>
<td></td>
<td>- Expand employment opportunities from aquaculture (ADS farmers or out-growers, out-growers for industrial producers, and/or SME service providers)</td>
<td>- Integrate and/ link to ADS</td>
<td>- Leverage small-service providers into SME and MSE (e.g. net menders, etc.)</td>
<td>- Leverage small-service providers into SME and MSE (e.g. net menders, etc.)</td>
<td>- Leverage small-service providers into SME and MSE (e.g. net menders, etc.)</td>
</tr>
<tr>
<td></td>
<td>- Financial management</td>
<td>- Business plans</td>
<td>- Integrate and/ link to ADS</td>
<td>- Integrate and/ link to ADS</td>
<td>- Integrate and/ link to ADS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Business development services</td>
<td>- Business development services for the different facets of the industry</td>
<td>- Business and investment plans</td>
<td>- Business development services for the different facets of the emerging industry</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Training for skills to service the different facets of the sector</td>
<td>- Appropriately skilled labour to service the different facets of the emerging sector</td>
<td>- Business and investment plans</td>
<td>- Appropriately skilled labour to service the different facets of the emerging sector</td>
</tr>
<tr>
<td>3. Access markets</td>
<td>- Post-harvest handling</td>
<td>- Post-harvest handling</td>
<td>- Sourcing and securing bulk markets collectively</td>
<td>- Sourcing and securing bulk markets collectively</td>
<td>- Sourcing and securing bulk markets collectively</td>
</tr>
<tr>
<td></td>
<td>- Standards, product development to promote village market-day sales (e.g. fried fish chunks)</td>
<td>- SPS standards/ BMPs</td>
<td>- Synchronising production among clusters/ association to supply markets</td>
<td>- Synchronising production among clusters/ association to supply markets</td>
<td>- Synchronising production among clusters/ association to supply markets</td>
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<tr>
<td></td>
<td></td>
<td>- Value-addition</td>
<td>- Value-chain SPS standards and traceability (inputs, primary and secondary productions)</td>
<td>- Value-chain SPS standards and traceability (inputs, primary and secondary productions)</td>
<td>- Value-chain SPS standards and traceability (inputs, primary and secondary productions)</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>- Product development and value addition</td>
<td>- Product development and value addition</td>
<td>- Product development and value addition</td>
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<td></td>
<td>- Branding/ labelling</td>
<td>- Branding/ labelling</td>
<td>- Branding/ labelling</td>
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<td></td>
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<td></td>
<td>- Market awareness and advertising</td>
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</thead>
<tbody>
<tr>
<td>4. Environmental biosecurity</td>
<td>- Basic knowledge of environmental issues associated with aquaculture</td>
<td>- BMPs for all aspects of production</td>
<td>- BMPs for all aspects of production along the value-chain (inputs, primary and secondary productions)</td>
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### 3. Roles of Extension Service Providers

<p>| 1. Public Sector | - Responsible for provision of all extension service to cater for their needs including on clustering - Registration/licensing | - Most extension needs met - Licensing | - Set standard guidelines for production covering all facets of the value chain (BMPs) and disseminate this information to stakeholders. - Devolve basic aspects of extension (e.g. primary production to self-run associations with capacity) - Oversea (monitor, evaluate, technical-backstopping,) quality of extension material, efficacy of different existing extension delivery mechanisms in both private and public sectors to ensure BMPs are will implemented and improve services. - Provide extension to smallholders | - Set standard guidelines for production covering all facets of the value chain (BMPs) and disseminate this information to stakeholders. - Devolve basic aspects of extension (e.g. primary production to self-run associations with capacity) - Oversea (monitor, evaluate, technical-backstopping,) quality of extension material, efficacy of different existing extension delivery mechanisms in both private and public sectors to ensure BMPs are will implemented and improve services. | - Set standard guidelines for production covering all facets of the value chain (BMPs) and disseminate this information to stakeholders. - Devolve basic aspects of extension (e.g. primary production to self-run associations with capacity) - Oversea (monitor, evaluate, technical-backstopping,) quality of extension material, efficacy of different existing extension delivery mechanisms in both private and public sectors to ensure BMPs are will implemented and improve services. |</p>
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<th>Emerging Fish Farmer</th>
<th>Start-Up Commercial Fish Farmers</th>
<th>Developing Commercial Fish Farmers</th>
<th>Aquaculture Industry</th>
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<td></td>
<td>- Guidance to private sector in outsourcing external service providers.</td>
<td></td>
<td>- Private sector likely to focus in providing extension where they have business interests. Therefore MS identify and fill in gaps not covered effectively by public sector e.g. biosecurity, new species for aquaculture, new production processes, promoting research findings, bilateral trade and formal training. - Provide extension to smallholders - Guidance to private sector in outsourcing external service providers.</td>
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<td>2. Private Sector</td>
<td>- As sector develops to industrial level, private sector may recruit and provide extension services to out-growers and train some to provide specific sectoral services</td>
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<td>- Extension services on best use of inputs/products (e.g. feed mills on use of feed, hatcheries on how to raise fish, etc.) within the framework of stipulated BMPs</td>
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### Progression of the Aquaculture Sector

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</table>
| 3. Producer Associations | - Mobilise farmers for training  
- Maintain and up-date group register | - Mobilise farmers for training  
- Some services e.g. dissemination of information  
- Maintain and up-date group register | - Register and operate based upon MS laws.  
- Provide some technical, extension and marketing services to members  
- Investments to provide sectoral services (independent or through public-private sector partnerships)  
- Advocacy | - Extension services to contract produce to produce desired products of right quality within the framework of stipulated BMPs | - Register and operate based upon MS laws.  
- Provide technical, extension and marketing services to members  
- Investments to provide sectoral services (independent or through public-private sector partnerships)  
- Advocacy |
Proposed Set-Up of a Competent Authority for Aquaculture Management to Enhance Extension Delivery.

It is proposed that the aquaculture extension and regulatory services of aquaculture department be undertaken separately by two different units in a clearly defined distinct manner so as to build confidence and trust of producers especially for purposes of sharing information. In such a case, below are suggested roles of the extension unit and regulatory unit:

<table>
<thead>
<tr>
<th>UNIT FOCUS</th>
<th>Aquaculture Extension Service Unit</th>
<th>Aquaculture Regulatory Service Unit (aquaculture inspectors)</th>
</tr>
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<tbody>
<tr>
<td>A healthy farm(ers), production environment and production-marketing value-chain; Viable industry =&gt; economic benefits</td>
<td>A healthy product and consumer health</td>
<td></td>
</tr>
<tr>
<td>ACTIVITIES</td>
<td>• Implement BMPS</td>
<td>• Check compliance of aquaculture establishments in conformity with licences issued and BMPs.</td>
</tr>
<tr>
<td></td>
<td>• National biosecurity control (disease and environment)</td>
<td>• Sanitary inspectors (SPS and traceability)</td>
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<td></td>
<td>• Post-harvest handling and processing</td>
<td>• environmental monitoring and audits</td>
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<tr>
<td></td>
<td>• Marketing (public awareness)</td>
<td>• Database for all controlled establishments (This should also be used to inform the extension services)</td>
</tr>
<tr>
<td></td>
<td>• Live fish movements</td>
<td>• Have SOPs for each inspection procedure (e.g. farms, feed mills, markets, input suppliers, processing units, etc.). Liaise with relevant inspection departments that may be in different ministries</td>
</tr>
<tr>
<td></td>
<td>• Supply of inputs (i.e. quality assurance)</td>
<td></td>
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</tbody>
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