

# Servicing the aquaculture sector: role of state and private sectors

## Expert Panel Review 5.2

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## Abstract

This paper was prepared by a group of authors of complementary experiences and presented during the *Thematic Session V: Improving knowledge and information sharing, research and extension in aquaculture* at the Global Conference on Aquaculture 2010, *Farming the Waters for People and Food* held in Phuket, Thailand on 22–25 September 2010. The paper, which draws particularly on experiences in Asia, the Pacific and Europe, reviews the role of aquaculture services, recent changes in requirements and delivery of services, and future opportunities and needs, with special reference to roles and responsibilities of state and private sectors. It concludes with recommendations drawn from the discussions at the conference, where the importance of investment in services across the sector was emphasized, noting the particular significance of equitable service delivery to smaller aquaculture enterprises in developing countries, including emerging aquaculture countries in Africa.

**KEY WORDS:** *Aquaculture servicing, Role of state and private sectors.*

## Background

This paper considers aquaculture services, and the role of the state and private sectors. According to the Organisation for Economic Co-operation and Development (OECD), the term “services” covers “a heterogeneous range of intangible products and activities that are difficult to encapsulate within a simple definition. Services are also often difficult to separate from goods with which they may be associated in varying degrees”<sup>1</sup>. In aquaculture, such services encompass a range of different products and activities that can be broadly categorized, albeit with significant overlap, as follows:

- a) *Extension:* Systems of communication for knowledge transfer and skills development that traditionally have provided practitioners with access to the required knowledge and skills on technologies and systems for aquaculture planning and operation. The term extension systems is now being, or at least should be, considered more broadly, encompassing non-technical services such as marketing and business advice or more broadly, empowerment of farmers in decision-making and better management. This is in recognition of the fact that rural farmers face many diverse challenges that go considerably beyond purely technical considerations.
- b) *Financial:* Services that provide access to finance for aquaculture infrastructure or operations, and insurance products. Such services may be delivered in various ways, from microcredit to larger-scale investment schemes, and involve private and public sectors.
- c) *Market:* Information and other services related to market requirements, prices and facilitation of market access and communication between producers, buyers and consumers along the value chain.

<sup>1</sup> [www.oecd.org/faq/0,3433,en\\_2649\\_34233\\_23183508\\_1\\_1\\_1\\_1,00.html](http://www.oecd.org/faq/0,3433,en_2649_34233_23183508_1_1_1_1,00.html)

- d) *Business*: Business development services that may include all aspects of aquaculture from investment to planning, development and organization.
- e) *Input provision*: Services involved in provision of inputs needed for aquaculture, such as production and delivery of seed, feed and other material inputs.
- f) *Infrastructure and transport*: A wide range of services that facilitate supply of inputs, water, and transport of products to market. Often physical infrastructure itself is not necessarily developed specifically for aquaculture, such as roads, dykes, electricity or sluice gates, but may indirectly provide benefits for aquaculture farmers or contribute to aquaculture development.
- g) *Technical services*: Consultancy and other technical services for aquaculture development and management, including environmental studies and analytical services for water and soil quality, pathology, input and product contaminants and residues. Analytical services are becoming increasingly essential for food safety assurance and addressing World Trade Organization (WTO) sanitary and phytosanitary (SPS) and technical barriers to trade (TBT) issues in the aquaculture sector.
- h) *Harvest and postharvest processing*: This service category may involve assistance ranging from harvesting to access to seafood processing facilities provided either through product sales or service arrangements.
- i) *Research and development*: This category includes services involving generation of new knowledge, improvements and solutions to problems, ranging from on-farm, action-type research to higher-level strategic research and longer-term investments such as genetic improvement programmes.
- j) *Communication*: This includes services that encompass a wide range of communication activities providing knowledge on a wide range of topics, from general news on developments, markets, policies, legislation, etc. through various media, and more focused services, including recent initiatives with short message service (SMS) and other information and communications technology (ICT) programmes focused in specific localities. Communication services of course more generally support the other services mentioned above.
- a) *Governance and regulations*: Governance of aquaculture is receiving increasing attention, and likewise several countries have established services to support and regulate industry development. These may include, for example, the Coastal Aquaculture Authority (CAA) in India, which regulates the activities connected with coastal aquaculture in coastal areas of the country.

### **Why are services important for aquaculture?**

Products and activities provided through such services are generally important from planning to operation of aquaculture enterprises, and throughout the whole “value chain” of aquaculture from input supplies, production through to marketing and consumption. They encompass the development of aquaculture in new

countries or regions, as well as improvements in efficiencies and technologies of established farming systems in existing aquaculture-producing countries. They are relevant, in various ways, for all types of aquaculture, from subsistence farming through the spectrum of aquaculture enterprises from micro and small-scale household-managed farms and businesses through to medium and large business. Broadly speaking, services in various forms have been and always will be an essential part of aquaculture development, and successful aquaculture development requires that the services needed are in place.

### **Who provides services and how are they delivered?**

Public and private sectors, including non-government agencies, are involved in provision of various aquaculture services, although roles and responsibilities differ and indeed have changed significantly in recent years. For example, the traditional roles of government in extension services are now shifting towards a more private-sector “user pays” orientation, including, in some countries and regions, an increasing role of private-sector organizations and farmer associations (such as the Federation of European Aquaculture Producers (FEAP)), non-governmental organizations (NGOs) or public-private partnerships in service delivery. The emergence of large aquaculture companies in nearly all regions, including recently Africa, has also facilitated their own development of a range of services covering in some cases all categories listed, for their own operations but also for aquaculture suppliers and producers associated with them.

Services also operate at various levels, from the local community through to regional organizations and international levels. International or bilateral donors and development banks have helped facilitate growth by investment in services in some countries, particularly developing countries. The mix of responsibilities in services and their delivery can be summarized as follows:

- a) *Extension:* The public sector traditionally leads, but there is increasing private-sector involvement, albeit with an emphasis towards larger enterprises. NGOs may also be active through donor investment projects, but these often lack sustainability. At the local level, farmers’ organizations may play a role, through the development of farmer trainers, resource persons or other services. A key issue is sustaining farmer organizations requiring a steady income stream.
- b) *Financial:* The private sector is dominant, although services may involve public-sector investments in infrastructure or guarantees or other risk management measures. Development banks, both national and international, also play an important role. Governments may also establish special funds for aquaculture, such as the New Zealand Government “Sustainable Farming Fund”, which was recently opened to aquaculture<sup>2</sup>. The “informal” private sector is widely involved, such as via credit provided

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<sup>2</sup> [www.maf.govt.nz/agriculture/funding-programmes/sustainable-farming-fund.aspx](http://www.maf.govt.nz/agriculture/funding-programmes/sustainable-farming-fund.aspx)

- by local traders, particularly in developing economies. Finance now flows easily across borders, and there are increasing international transboundary investments in aquaculture. Donors are also involved in various ways, but the trend is that donor projects should not be involved in sector-specific credit, rather they should facilitate the development of financial systems that provide benefits to a wider range of rural enterprises. Obtaining capital for aquaculture can be a formidable task for many aquaculturists (Pomeroy and Getchis, undated), and small-scale commercial aquaculture farms face particular difficulties in accessing finance in many countries.
- c) *Market*: The private sector dominates, although the public sector is involved to various extents, such as in infrastructure and knowledge transfer mechanisms, including intergovernmental agencies such as INFOFISH. This involvement may be through regulatory provisions, such as for traceability. The emergence of demand by retailers and large buyers of certified or “sustainably produced” aquaculture products has recently led to an increase in services provided by intermediaries connecting producers to buyers of higher-value produce, particularly for internationally traded products such as shrimp and catfish.
  - d) *Business development services*: The private sector is dominant, although the public sector or donors may also assist in providing financial or other support to development of such services for rural communities, although this support is often tied to projects and may lack sustainability as a result.
  - e) *Input provision*: The private sector dominates in providing access to the inputs needed for aquaculture, such as seed, feed, etc. The role of governments and increasingly, international agencies, is more in the setting and management of quality standards and in traceability.
  - f) *Infrastructure and transport*: There is both public and private-sector involvement; government financing and policies may have a significant influence on infrastructure development.
  - g) *Technical services*: The private sector dominates through independent businesses or linkages to large companies or groups of producers, but government agencies play an important role in some countries, especially with regard to environmental aspects or where there are social objectives, such as investing in technical services to small-scale farmers.
  - h) *Research and development*: The public sector traditionally leads, but private-sector research and development (R&D) is becoming more significant as aquaculture grows, particularly among larger international businesses. Universities are also involved in R&D service provision. There is increasing recognition of the importance of involving farmers in “action research” type approaches.
  - i) *Processing*: Usually, only the private sector is involved, but governments can facilitate or regulate arrangements between farmers and processors.
  - j) *Information*: Both the public and private sector are involved in communication services, but the private sector is increasingly dominant. New social networking tools are also opening new avenues for knowledge transfer.

Government roles in all the above vary considerably from country to country and at various stages of the development process. Other related interventions from government may include subsidies, supporting minimum prices from time to time, or provision of tax incentives for investors in aquaculture. The influence of the government and the policy attention given to aquaculture, therefore, plays an important role in aquaculture development and also the ways in which private services develop.

## **How has the situation changed/improved over the past decade?**

### **What are the major changes in type of and need for services?**

Growth in aquaculture over the past ten years, influenced by a range of global drivers, has changed not only the nature of the services required but also the way in which these services are delivered. While this is generally true, it should be recognized that the services required by different socio-economic groups can be rather different, e.g. in extension modes, inputs supplies and credit modalities, and in the response and needs related to global drivers.

Global drivers that are influencing services include:

- the increasing demand for aquaculture products, driving growth, investment and in some countries, the increasing numbers of farmers engaged in aquaculture;
- consumer and retailer demands for “sustainable” and “safe” products, leading to the requirements for food safety assurance and certification;
- globalization trends that have eased the way for transnational investment and an increased flow of services and aquaculture products;
- integration of supply chains for seafood products; and
- major progress in Internet and other technologies facilitating communication.

In less-developed and newly emerging aquaculture countries, investment in basic services is still required to support growth of the sector, particularly if it is to deliver benefits that many countries and donors seek in improving the livelihoods of people living in rural societies. In others, market pressures, in particular the recent moves towards certification and food safety and quality assurance, have created new requirements for extension, business advice and technical services that can be provided by both the private and the public sectors.

While a wide range of services are needed to enable the growth and sustainability of aquaculture, equitable access to service remains uneven. Beyond subsistence farming, still found in some regions such as Africa, the micro and small aquaculture enterprises, largely involving households and operated as small-scale family businesses, involve large numbers of people, and remain socially and economically important to many rural communities, particularly in Asia but also in other regions. Such family-oriented enterprises

face increasing problems in participating equitably in some modern value chains for aquaculture products due to such factors as:

- costs associated with achieving efficiency of scale and establishing modern business structures;
- inequitable access to markets and market information;
- difficulties in access to financial and technical support services;
- environmental constraints; and
- increasingly high production standards, food safety and quality assurance requirements if farmers wish to engage in international markets, and increasingly more demanding domestic markets.

While rising domestic demands in many Asian countries and in Africa provide perhaps easier entry points for households to markets, services will also be required to achieve market access. Certification for access to both developing and developed markets risks excluding small-scale entrepreneurs from opportunities to improve livelihoods through aquaculture. Exclusion of smaller producers from export markets risks significant social and economic impacts in some rural and coastal communities across Asia. In Africa, growing recognition of the role of small and medium enterprises as a pathway for aquaculture growth will also require special attention to investment in services. In Europe, the concerns for the smaller farmers are identical to those elsewhere since, without certification, it is virtually impossible to supply the multiple retail stores, which are responsible for 85 percent of retail sales in northern Europe. In markets where food safety and consumer interests dominate, these positions are unlikely to reverse.

Equitable access to services for smaller aquaculture enterprises and household-level producers is a challenge in most developing countries. As a consequence of new market requirements and in order to support their aquaculture industries, governments have had or will need to invest in some basic services, in particular, surveillance and analytical capacity, such as for food safety assurance, and aquatic animal health management measures. There is, however, an evolving “aquaculture divide”, with many rural farmers, particularly in less developed countries, still having limited access to requisite aquaculture services. Nonetheless, it is observed that, at least, there is a growing awareness of the need for better services for the small-scale sector, and a direction for the future will be to look for service improvements that deliver the necessary support.

The small-scale sector needs different services from the conventional transfer of technology mode of extension and credit from formal credit institutions. There are large numbers of farmers in Asia that are not producing for the international market. Most of the improvements needed in the early stages of aquaculture development require basic skill levels, and do not need a degree in aquaculture to communicate such skills to farmers. Formal government services commonly do not extend beyond a few kilometers of district centers in many countries, and

thus there is a need for a system to bridge the gap down to the field level, and here there is increasing recognition that farmer organizations can play a role.

### **What are the major changes in delivery of services?**

Essentially, the aquaculture sector lags behind the agriculture sector in development of many support services, particularly in rural areas of developing countries, and indeed there are still many significant gaps. Nevertheless, we can see some major changes in the way that services are being delivered in aquaculture, and opportunities, particularly with the rising role of communication technologies and Internet. There is also a rising capacity in Asia for management of the sector and delivery of services both in the public and private sectors. Within Europe, on-line sales and traceability services are providing new means for distance selling but evidently require adaptation of the way in which sales and marketing are viewed by the operator.

Market requirements and the increased frequency of occurrence and diversity of aquatic animal pathogens have increased the need for both the public and the private sector to develop technical and analytical services in order to guarantee the health of cultivated animals and the safety of the products.

### **What are the major changes in the role of government and private sectors?**

In many countries, the government role in extension services has reduced during the past ten years, while the role of private business has increased. Public and private services available (e.g. government extension systems, private feed and pharmaceutical companies) tend, however, to be oriented towards the larger enterprises and currently do not adequately support the smaller-scale enterprises and farmers, let alone provide a mechanism for improvement. This is partly because small-scale farmers are considered “difficult” and often because the necessary skills and investment required for the service envisaged are not available or well targeted. In the agriculture sector, the business opportunities among many millions of small-scale rural farmers have been recognized – through such classics as Prahalad’s *The fortune at the bottom of the pyramid* (Prahalad, 2006) – and products and services oriented towards small-scale rural consumers. There is a need for business models of services for smaller-scale aquaculture farmers, perhaps in cooperation with smallholder-oriented agriculture or other rural services.

Within Europe, private-sector networks (usually within associative structures) provide information and related support services, which can include generic marketing actions. These structures also provide the link of the sector to government, enabling needs identification and the manner in which essential services can be provided. Nonetheless, the key suppliers have developed their own capacity to be able to provide valuable on-farm services.

Globally, but mostly in North America and Europe, governments originally invested in developing the aquaculture technology that is now used by the private sector and continuously improved mostly by well-financed, large companies. Now governments focus their efforts more on research and surveillance programmes to ensure a sustainable future to the aquaculture industry.

## Some examples and lessons learned

Projects across Asia are starting to show that providing access to simple skills and technologies can make significant differences to small-scale aquaculture households and small and medium aquaculture enterprises. Experiences of a number of agencies in Bangladesh, India, Indonesia, Thailand and Viet Nam have demonstrated that the adoption of simple management improvements and organized collective improvements, such as self-help groups, can reduce costs, reduce the risks of disease outbreaks, reduce environmental impacts, improve profits and provide better livelihoods<sup>3</sup>. The challenge in moving forward is not to continue to replicate such “pockets of success”, but to leverage such local successes to scale up such experiences across a wider swathe of aquaculture farmers and small and medium enterprises (SMEs) in Asia (Umesh *et al.*, 2009).

Seafood safety issues and bans from importing countries resulted in several governments imposing new regulations and controls to the aquaculture industry, which seems to contribute in great measure to the sustainability of the activity through improved management and environmental awareness. In that sense, markets have also played an important role in creating the need for improved services to the aquaculture industry. Selected experiences are provided below.

### **Bangladesh – Danida experiences**

Danish International Development Agency (Danida) projects in Bangladesh have emphasized development of local services, and used a farmer field school (FFS) approach in extension. FFS has been used to help farmers to analyze their own situation and share experiences to effect low-cost improvements in their existing systems. The FFS are facilitated by young people from the local community trained by the Danida technical assistance project in how to conduct such FFS and in the options for technical improvement. On this basis, it appears that household earnings from aquaculture can be significantly increased in a short time through basic improvements in aquaculture farm management and technologies. Training is supported by service provision by farmer organizations. Sustaining such services will require investment by government, but also business models that can generate income for services.

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<sup>3</sup> As an example, investment in technical services of USD66 000 led to increased profits for 700 small-scale Indian shrimp farmers of around USD1.4 million in 2006 (Umesh *et al.*, 2009).

## India – NaCSA experiences

Public and private sectors both have important roles in the India National Center for Sustainable Aquaculture (NaCSA) model. No one sector can completely fulfill the needs of small-scale farmers. Most small aquaculture farms in India lack basic infrastructure facilities like roads, bridges, electricity and other requirements, in common with many other farmers in poor rural areas. The public sector can play an important role in developing infrastructure facilities and empowering small farmers by providing information and training which are basic needs. The reason most governments are lacking in aquaculture service compared to agriculture is that aquaculture is of recent development and there is a lack of information on the potential role the sector and its ancillary industries play in rural development. Lessons learned in NaCSA (Umesh *et al.*, 2009) are.

- Government can play a key role in development of infrastructure facilities for small-scale aquaculture and assisting in with finance. The Indian Government recently has come up with financial support for infrastructure development (electricity, roads and bridges) and is also writing off 50 percent of the premium on insurance for small-scale aquaculture. This was made possible through the registration of nearly 20 000 small farmers (25 percent) with the government in the last two years, which was facilitated by NaCSA.
- Providing information/training to small farmer groups empowers farmers to make appropriate decisions and solve their common problems.
- Simple management improvements through organized farmer groups can reduce costs, reduce risks of shrimp disease outbreaks, reduce environmental impacts, improve profits and provide better livelihoods.
- Better infrastructure facilities will enhance implementation of better practices and help to improve productivity.
- Better market prices encourage farmers to invest in better farming practices.
- Business-oriented private-sector service tends to focus on large-scale farmers for economy of scale, with small farmers often being ignored. Services are often provided by feed and chemical suppliers mainly to promote their business interests.
- Procuring good quality seed is still a major challenge for small farmers and is critical for the success of their operations.
- Organizing farmers also encourages entrepreneurship. Farmer groups have come forward to start their own hatchery to cater to their own demand for quality seed.
- Small farmers are resilient; with better service provision their living standards can be further improved.

## Seafood Services Australia

Seafood Services Australia (SSA, [www.seafood.net.au](http://www.seafood.net.au)) is a not for profit company established in 2001 and supported by the Australian seafood industry and the Australian Government through funding from the Fisheries Research and Development Corporation. The goal of SSA is to enhance the

profitability, international competitiveness, sustainability and resilience of the Australian seafood industry. As the domestic and global markets become ever more complex and sophisticated, the competitiveness of Australian seafood businesses is being challenged. These challenges are beyond the capacity of individual businesses to address. SSA works with seafood industry people and extensive networks and alliances across industry and government to improve industry practices and to capitalize on opportunities that would not otherwise be realized. The service helps create the incentives and tools for the industry to act as a united seafood industry, to build an environment in which individual businesses can be more profitable and sustainable. Priorities are:

- trade and market access;
- cost of regulatory compliance;
- environmental accreditation;
- strategic alliances; and
- cost of production.

The programme is guided by the SSA Business Plan (SSA, 2007), and programmes are developed with extensive stakeholder input. The four programme areas are (1) Security of Supply; (2) Security of Markets; (3) Product Integrity and Standards; and (4) Knowledge Broker.

### **Have the expectations and commitments expressed in the bangkok declaration been met?**

The Bangkok Declaration does not refer specifically to services as such, but services are directly and indirectly referred to in various elements of the *Strategy for Aquaculture Development Beyond 2000* (NACA/FAO, 2000) as noted in Box 1. In general, there has been progress in many aspects of service provision; however it is questionable whether “improving the capacity of institutions to

#### **BOX 1. Relevant elements of the Bangkok Strategy for Aquaculture Development Beyond 2000**

- 3.1 Investing in people through education and training – the importance of education and training services
- 3.2 Investing in research and development
- 3.3 Improving information flow
- 3.4 Improving food security and alleviating poverty – where the emphasis of services is noted to deliver support among poorer groups involved with aquaculture
- 3.7 Investing in aquaculture – where the importance of investment and credit is noted, including micro-finance for smaller-scale producers
- 3.8 Strengthening of institutional capacity
- 3.9 Managing aquatic animal health – includes reference to improvement in services
- 3.10 Improving food safety and quality
- 3.11 Promoting market development and trade – which includes reference to market access

develop and implement strategies targeting poor people” has improved or approaches tried have been effective. This aspect remains a key challenge for the future. Focus in improving institutional capacity has perhaps been too focused on central governments and their officers at the local level and not enough upon local government and other local organizations.

### **What are the future expectations?**

The future growth of aquaculture requires that the services needed are in place, with roles and responsibilities for public and private sectors. It will also need strengthening of partnerships among various actors to ensure services are delivered effectively and respond to needs. These needs include not only those of producers, but those of the whole value chain. Actual requirements will depend on the growth and future scenarios, as well as regional and country differences, but there are several major complementary directions for the future:

- improving access to services that deliver to larger number of farmers, particularly in developing countries;
- increasing the quality of services to respond to current and future needs for all enterprises;
- adopting a more collaborative approach, with different partners bringing complementary skills and resources to deliver the services required; and
- taking a value-chain and more business-oriented approach that takes account of all aspects of aquaculture production through to market.

Such approaches will require new investments and in some cases new policies, tools and infrastructure interventions (e.g. see agriculture approaches in the World Economic Forum, 2010). Analysis of national aquaculture strategies and existing services, and stakeholder consultations can be a starting point for reforms and investment in better services.

In Europe, the family farm and smaller enterprises face many of the same difficulties reported in Asia: access to markets, lack of economies of scale, requirements for new skills and others. This has led to buy-outs and consolidation of different components of the sector, so while production does not reduce, the number of separate enterprises does through consolidation. This leads inevitably to an increasing divide between the larger companies and smaller-scale farming activities. Assuring the survival of the smaller aquaculture entities will be based on the assurance of access to the services described and also the manner in which they can access the markets that is required for their capacity to continue their activity. Inevitably, this means either focusing on local markets or grouping within structures that will enable access to larger national or international markets.

In Asia, a major challenge remains to improve the access to services for many smaller-scale aquaculture enterprises. Experiences in Asia in addressing such

issues have shown that short-term technical assistance projects can achieve good success with helping farmers to organize self-help groups and adopt better management practices (BMPs); however, sustaining achievements beyond an individual project cannot be done effectively without more attention to creating sustainable, business-oriented institutions. New approaches are needed in the way that technical, financial and market services are organized and delivered to farmers; where governments have been dominant in extension in the past, with mixed results, there is a need to shift attention to more business-oriented servicing solutions, networked for economies of scale and knowledge sharing, if small-scale farmers and communities are to be an important part of future aquaculture growth. New technologies, such as spread of the Internet and mobile phone service through many rural areas may also offer many opportunities for provision of necessary services in a more cost-effective manner, taking account of efficiencies of scale.

Farmer organizations may need to play a more important role (Kassam, Subasinghe and Phillips, 2011). Such organizations should more than recover costs for their services in order to become financially sustainable. Arguably, they should be offered grants as a start to making the necessary economic investments and developing the financial strength to make them “bankable” in the sense of borrowing from the commercial sector.

An issue here is whether such institutions can be dependent on a single sector. Most small farmers are not specialists and need services in crops, livestock and even handicraft supplies, not just aquaculture. Such organizations need to make links with local, subregional and national suppliers of quality inputs and with markets. To be effective in bargaining/negotiation, this will often involve associations or federations of grassroots organizations. Without further investment in new approaches to service delivery, the small-scale enterprise pathway for future growth of aquaculture will be far from assured. Research is needed on producer companies, cooperative arrangements, contract farming and other more socially oriented enterprise models to design and support appropriate sustainable approaches (e.g. Prahalad (2006), and experiences from the agriculture sector, such as Anon. (2005)).

## Panel recommendations

The following recommendations were developed by the panel and further discussed during the Phuket conference:

- A wide range of services are essential for future growth of the aquaculture sector. There are many good initiatives, but the challenge is delivering the right combination of services to users, ensuring equitable access and creating impact at scale, particularly to large numbers of small-scale producers. New technologies, non-conventional approaches and new investments are required.

- The state and private sectors both have roles to play. Appropriate roles and responsibilities of the public and private sectors in providing aquaculture services should be clearly defined in participatory policies, strategies and plans, to foster private-sector led approaches wherever possible, to identify any market failures that require public-sector responsibility for provision of services, and to avoid competition and increase complementarities between public and private services delivery.
- There is no “one size fits all” model, but there is a need for sharing and networking of experiences to work at scale.
- Farmer organizations and local institutions that support such organizations and provide services require special attention.
- Small-scale farmer groups and clusters should be promoted wherever there are small-scale aquaculture farmers. Cluster formation should be a part of government policy as a development activity to assist small-scale farmers. Setting up incentive structures and creating reward and support systems that motivate farmers to scale up such programmes are required. Groups and clusters should be formalized or registered as a group for accountability. Training tools should be developed to assist government, NGOs and private service providers in forming clusters, taking in to account existing experiences.
- Success stories should be widely publicized to inspire national and local-level efforts to promote formation of farmer groups.
- Broad stakeholder networks, including farmers and their organizations must be created. Effort must be made to bring together federations of farmer groups in different countries to create economies of scale and social capital to increase bargaining power.
- Public services cannot be sustained indefinitely, and appropriate business models for services should be explored and promoted, including in rural areas and using models that work for small-scale farmers. Private-sector investment should be encouraged in models that work for small farmers.
- Extension service by private companies must be encouraged and general guidelines have to be laid out to ensure a responsible approach. Business models that support farmer groups, local servicing systems and networks, and deliver services to small-scale rural farmers should be developed.
- Investment in services can be guided by creating a strategic plan for services in each area/region. A strategic plan for services could then be used as a guide to all aspects of services, including funding by various investors into the future. From that knowledge, actions could be taken based on needs. To support this, there is a need for (1) a list of all services and what they do in each country (Priority should be on countries that are considered poor and working upwards. This enables looking at gaps and communication hubs or assists in creating collaboration across the services already in place); (2) a list of all examples, and small case studies done on a few to give people examples of what can be achieved; and (3) a prioritized list of services that need to be created in each area/region filtering down to countries.

- Small farmers are a diffuse target and servicing them adequately is often too demanding for governments with limited financial resources and profit-oriented commercial partners. There is an urgent need for small farmers to cluster so they can be viewed and supported as organizations, which in turn would have the capacity to develop some internal services to their members as a complement to external support.
- New market and certification requirements are a challenge, but also an opportunity to introduce changes in the organization of the aquaculture industry, and in particular improve services to small farmers.
- There is a need for investment in scaling up existing projects that have potential to becoming self-sustaining enterprises.
- There is a need to build coalitions among investors to ensure the necessary services are provided.
- Africa is emerging as a strong region for future aquaculture development, and further attention is required on the services needed to develop and sustain the growth of aquaculture within the continent. Lessons learned from other regions may provide useful guidance, but ultimately investment in and the growth of strong indigenous services will be necessary. Further analysis of requirements would be useful in assessing future servicing needs and strategies.

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