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EXTENSION FOR AQUACULTURE DEVELOPMENT

Executive Summary

Aquaculture is a knowledge-, technology- and skill-demanding business that requires extension services for capacity development of human resources. The paper discusses the scope, modalities and lessons learned on aquaculture extension. FAO's roles in improving the efficiency and effectiveness of aquaculture extension are highlighted.

The Sub-Committee is invited to:

- comment on the information presented in this document;
- share experiences and lessons learned in aquaculture extension;
- recommend actions and activities towards improving the efficiency and effectiveness of aquaculture extension.

1. Aquaculture is a knowledge-, technology- and skill-demanding business that requires extension services for capacity development of human resources.

2. Aquaculture extension services have been focused primarily on transferring aquaculture technologies, improving fish farming skills and promoting good practices in technical areas, such as site selection, farming systems and technology, seed production, feed management, fish disease and biosecurity, water management, harvesting, post-harvest handling, marketing and record keeping.

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3. Aquaculture extension services are also provided for economic development such as business planning and financial management. Yet considering the potential role of economic and financial knowledge and skills towards improving the economic performance of aquaculture, the effort and depth of these extension services are much less than those focusing on technical aspects.

4. Extension has undergone profound changes over time with an increasing scope in terms of both contents and recipients. While agricultural (including aquaculture) extension often is narrowly defined as “technology transfer”, it should be broadened to encompass human resource development that focuses on learning and building farmers’ self-confidence and their capacities in networking, problem solving and decision making.¹ Aquaculture extension services should be provided to not only fish producers but also to ancillary and supporting businesses, such as seed producers, feed formulators, net makers, harvesting teams, fish traders and other key players in the value chain.² Internet access availability through mobile phones to large sectors of the rural communities in developing countries will be an important agent of change, and is likely to change also the way rural communities will receive new knowledge and new ideas.

MODALITIES OF AQUACULTURE EXTENSION

Government extension

5. In most countries government is the primary force in aquaculture extension. In China, the largest aquaculture producer, accounting for nearly 60 percent of world production, there are nearly 30 000 full-time, professional aquaculture extension workers in nearly 15 000 extension stations that either specialize in aquaculture extension or include aquaculture under general agricultural extension. On average, each of the public extension worker serves about 170 full-time fish farmers and contributes to over 2 000 tonnes of aquaculture production.³

6. Through training and visit (T&V) activities, government extension workers raise the awareness of aquaculture, help potential farmers enter the aquaculture sector and provide technical advice on farming practices and business management to both new and established farmers.

7. Government also supports core farmers (mostly progressive or commercial farmers) to receive extension services (e.g. training courses, study tours, etc.) provided by other institutions and establishes or subsidizes demonstration farms with the aim that knowledge and skills could trickle down from core farmers and demonstration farms to grass-root farmers.⁴

8. Government extension, which is often free of charge to the farmer, is vital to disadvantaged (e.g. poor or illiterate) or vulnerable (female or disabled) fish farmers that may find other extension options relatively inaccessible or unaffordable. Unfortunately, in many countries the capacity of government extension with regard to technical know-how in aquaculture is weak and insufficient in

¹ Qamar, M.K. 2005. “Recent developments in agricultural extension”, in Halwart, M., Kumar, D. & Bondad-Reantaso, M.G. (comps). Papers presented at the FAO/NACA Consultation on Aquaculture for Sustainable Rural Development. Chiang Rai, Thailand, 29–31 March 1999. FAO Fisheries Report. No. 611, Suppl. Rome, FAO. 282 pp.

² Thomsen, S. & Islam, Md.M. 2005. “Experiences gained from the DANIDA-assisted Mymensingh Aquaculture Extension Project in Bangladesh”, in Halwart, M., Kumar, D. & Bondad-Reantaso, M.G. (comps). Papers presented at the FAO/NACA Consultation on Aquaculture for Sustainable Rural Development. Chiang Rai, Thailand, 29–31 March 1999. FAO Fisheries Report. No. 611, Suppl. Rome, FAO. 282 pp.

³ China Fishery Statistic Yearbook 2016.

⁴ Kumar, D. 1999. Trickle down system (TDS) of aquaculture extension for rural development. RAP Publication 1999/23. Regional Office for Asia and the Pacific, Food and Agricultural Organization of the United Nations. Bangkok, Thailand.

terms of number of well-trained aquaculture extension officers to address the growing needs of rural communities.

Extension provided by IGOs or NGOs

9. Intergovernmental organizations (IGOs), such as FAO, the World Bank and the Network of Aquaculture Centers in Asia-Pacific (NACA), and civil societies (e.g. NGOs) provide aquaculture extension services through various projects, often supporting the further development of national and local extension services. Extension is often a component of IGO or NGO projects with broader objectives in rural development. For example, an NGO specializing in rural community development may extend its efforts from improving farmers' parenting skills to strengthening their farming skills.

10. Historically, international development interventions have had mixed success in extension, with a particular challenge in maintaining the level of technical quality once the project funds are exhausted, leading to inadequate anchorage and long-term sustainability of the interventions activities. This is one of the reasons that direct technology transfer, without more holistic capacity development aspects, is not a robust strategy for agricultural extension. Even so, extension workers trained through these types of interventions have a role in future work as well as increased opportunities in the private sector.

11. Through various training-of-trainer mechanisms (e.g. training courses, workshops, seminars, etc.), extension services under an IGO or NGO project are provided to a core group of farmers, government extension workers, private service providers and other actors who are expected to further disseminate the knowledge and skills to grass-root farmers.

Extension provided by research institutes

12. Research institutes, including international research organizations (e.g. WorldFish), regional research institutes (e.g. Asian Institute of Technology (AIT)), advanced aquaculture institutions (e.g. Stirling University) and national research institutes (e.g. Freshwater Fishery Research Center (FFRC) in China), play important roles in aquaculture extension. Research institutes are one of the main forces behind technology advancements. Many research institutes offer regular or ad-hoc training courses on various technical subjects. Some research institutes make extension a mandatory part of staff duties.⁵

13. Multiple factors, such as the focus of research institutes and the interests and career incentives of researchers, determine how much extension activities a research institute can undertake. Generally, extension services are limited to a small number of core farmers (i.e. training of extension agents) and rely on extension agencies to pass on their knowledge and technical know-how to grass-root farmers.

Extension provided by the private sector

14. Key actors in the aquaculture value chain (e.g. hatchery operators, feed, medicine and/or other material suppliers, fish traders, processing plants, etc.) often provide extension services to fish farmers free of charge in order to facilitate their business transactions with farmers. They are geographically close to farmers and therefore can provide timely and relevant extension services.

15. Private service providers (e.g. aquaculture consultants) provide extension services to fish farmers for a fee. Many such service providers are fish farmers themselves. For many countries with weak government extension, private service providers play a crucial role in aquaculture extension. For example, fish farmers in many African countries often seek advice and guidance from private service providers on various subjects on aquaculture. Extension in certain areas that entail specialized expertise (e.g. site selection or fish health management) is usually provided by private service providers.

⁵ For example, a faculty member in a land- or sea-grant university in the United States of America can be an extension specialist whose staff time is primarily devoted to extension. A research-oriented faculty member in the university may also have some percentage of his or her staff time devoted to extension.

Farmer-to-farmer extension

16. Farmers provide extension services to fellow farmers by sharing technical know-how and experiences or helping them solve problems. The effectiveness of farmer-to-farmer extension is vital to the validity of the trickle-down modality.

17. Farmer-to-farmer extension is a vital aspect of participatory extension methods such as Farmer Field School (FFS)⁶, or more specifically, Aquaculture Field School.⁷ The participating fish farmers in an FFS develop their skills during the FFS activities at the communal experimental field/pond, and then adopt these practices and techniques on their individual fields/ponds and disseminate the corresponding knowledge to friends, relatives and neighbours. This snowball effect is one way in which the FFS approach is able to expose and extend practices to large numbers of farmers.

18. Farmer-to-farmer extension can also be conducted on a regular or ad-hoc basis through technical networks on the internet (e.g. SARNISSA).⁸

Self-education

19. In addition to various extension services discussed above, many farmers acquire knowledge and skills through self-learning from books, technical manuals, radios, videos, internet and other information sources. Information technology (IT) advancements have given farmers access to a vast amount of information through various media. However, directly applicable knowledge and experience are not always easy to find, especially for farmers in a less developed aquaculture sector. Non-local knowledge and experiences may not be understandable because of language barriers or applicable because of farmers' lack of capacity to adapt them to local conditions.

KEY LESSONS LEARNED ON AQUACULTURE EXTENSION

Improving government extension on aquaculture

20. The inadequacy of some government extension services, in terms of both quantity and quality, has been a major constraint to human resource development in aquaculture, especially in countries with an underdeveloped aquaculture sector.

21. For countries with a relatively small aquaculture sector or a limited extension budget, government extension services are sometimes provided by employees who are also responsible for other duties (e.g. administration).⁹ Inadequate in-service training and the lack of incentives in providing high-quality extension services are common factors that hamper the performance of government extension workers. The lack of funding also hinders government staff engaging in extension activities (e.g. field visits).

22. Well-trained aquaculture professionals are often in short supply and high demand, and thus working as a government extension worker may be a less attractive and lucrative career than research, administration or better-paid opportunities in NGOs or the private sector.¹⁰ One option to recruit highly

⁶ Global Farmer Field School Platform www.fao.org/farmer-field-schools/en/

⁷ ICAR-CIFA. 2016. Aquaculture Field Schools. ICAR-CIFA Extension Series – 28. ICAR-Central Institute of Freshwater Aquaculture Indian Council of Agricultural Research, Odisha, India (http://cifa.nic.in/sites/default/files/AQUACULTURE%20FIELD%20SCHOOLS_1.pdf).

⁸ Sustainable Aquaculture Research Networks in Sub Saharan Africa (<http://www.sarnissa.org/HomePage>).

⁹ FAO Fisheries Department, Inland Water Resources and Aquaculture Service. 2004. Aquaculture extension in sub-Saharan Africa. FAO Fisheries Circular. No. 1002. Rome, FAO. 55 pp.

¹⁰ Varadi, L. & Pekar, F. 2005. "Experiences of the Fish Culture Research Institute (HAKI), Szarvas, Hungary in rural aquaculture development in Asia", in Halwart, M., Kumar, D. & Bondad-Reantaso, M.G. (comps). Papers

qualified professionals is to provide a mechanism for government extension staff to consult for private and commercial businesses during their non-working days, but caution needs to be exerted to maintain the integrity of the government extension services.

23. Privatization mechanisms (e.g. use of extension vouchers, Costa Rica¹¹) have been used to improve the efficiency and effectiveness of publicly-funded extension; government, instead of providing extension services directly through its employees, outsources the services by subsidizing farmers' purchase of extension services provided by private extension agents. A privatized extension system needs oversight and management, and still may deprive small or novice farmers of adequate extension services because of their lack of appreciation of the value of extension services or their inability to distinguish between high- and low-quality extension services.

24. Agricultural extension is decentralized in many countries, meaning that extension activities are planned and managed by district or provincial level authorities. Decentralization has the potential benefit of allowing more flexible, locally adapted, efficient and relevant aquaculture extension.

Pluralistic approach plus effective coordination

25. There are no extension modalities that fit every situation; aquaculture extension should be tailor-made for different clienteles¹² by multiple extension providers according to their respective comparative advantages. This type of pluralistic approach entails coordination among various extension entities based on their respective comparative advantages in aquaculture extension. Without effective communication and coordination, extension efforts of various government and non-government organizations can result in waste of resources in overlapping or duplicating activities and may cause confusion.¹³

26. Government has a role to play by creating an enabling environment to facilitate and coordinate extension provided by other partners (e.g. IGOs, NGOs and private extension providers) and using its human and financial resources to identify and fill gaps with the view to create a robust and pluralistic extension package. One key opportunity for the government is the communication and dissemination of successful interventions field tested by NGOs to large numbers of farmers, with the goal to up-scale the positive results to create greater impact at national level.

Mainstreaming the participatory approach

27. Participatory approaches, which tend to be more effective yet more time and effort consuming, are less common than top-down extension.

28. Many aquaculture extension services are provided to farmers free of charge, and in consequence there is a tendency for extension agents to view farmers as merely "recipients" or "beneficiaries". One risk is that farmers become discouraged by irrelevant or inapplicable knowledge and skills bestowed top-down, seemingly without input to the process. At the same time extension workers may become frustrated by the ineffectiveness of their efforts, the improper targeting of interventions and possible

presented at the FAO/NACA Consultation on Aquaculture for Sustainable Rural Development. Chiang Rai, Thailand, 29–31 March 1999. FAO Fisheries Report. No. 611, Suppl. Rome, FAO. 282 pp.

¹¹ See the reference in footnote 1.

¹² These clienteles can be defined in many ways, for example: economic status (resource poor vs commercial), farm size (household production vs market-oriented), environmental/geographic location (water scarce areas, tropical vs temperate climates), vulnerability (youth, women, physically disable, illiterate) or by technical area to address specific demands (market oriented farming, disease management, feed improvement).

¹³ Islam, N. 2005. "Status and role of aquaculture in rural development in Bangladesh", in Halwart, M.; Kumar, D. & Bondad-Reantaso, M.G. (comps). Papers presented at the FAO/NACA Consultation on Aquaculture for Sustainable Rural Development. Chiang Rai, Thailand, 29–31 March 1999. FAO Fisheries Report. No. 611, Suppl. Rome, FAO. 282 pp.

wasted resources. For example, T&V is often criticized as a top-down approach that tends to be rigid, lacking two-way communication and not cost-effective.¹⁴

29. Aquaculture extension services under IGO or NGO projects often use external (non-local) experts from foreign countries, and though these people are highly technically qualified, there is a critical need to adapt their knowledge to meet the local cultures, experiences and needs. Local experts should be involved during the design phase of the extension intervention, and activities should reflect local realities while ensuring cultural- and gender-sensitivity of the activities. If not, one risk is that technologies and practices may be incorrectly targeted to beneficiaries.

30. Actions should be taken and mechanisms established to facilitate farmers to participate in the design of extension materials and activities, starting at the earliest stages of project formulation. This does not mean that every training course needs to be co-designed by the trainers and trainees together—this is not always feasible because of limited resources or farmers' capacities. Rather, extension agents should be motivated and enabled to continuously and systematically improve the quality and relevancy of their services based on farmers' feedback.

31. For IGOs or NGOs that provide extension services continuously through a large number of diverse projects and relying on external experts recruited on an ad-hoc basis, it is important to establish protocols for extension activities (e.g. training courses) and constantly update them based on experiences gained and lessons learned in each and every extension activity. For example, aquaculture experts conducting a training workshop on best management practices should be required to field-test their extension materials before using them in the workshop. Business consultants organizing a training on business planning should be required to use data collected from the field to design the financial analysis exercises used in the training instead of using hypothetical or ad-hoc materials that are unfamiliar to the trainees.

32. Better yet, efforts could be exerted to synthesize the experiences of all major IGO and NGO extension activities to find common denominators for success stories. For example, many experiences indicate that partnership among farmers and between extension workers and farmers through group approaches is an effective mechanism to facilitate training and extension activities.¹⁵

Strengthening the linkages between research and extension

33. Weakly structured linkages between research and extension communities and the lack of effective two-way mechanisms to bridge the knowledge and skills gap between researchers and extension officers have led to inefficient or ineffective knowledge generation and dissemination.^{16,17}

34. Extension workers often complain that the results of much research (even applied research) are of little relevance to farmers' needs; whereas researchers continue directing their own research efforts and those of their students according to academic interests and career development incentives.

35. Extension, with the aim of solving problems, requires multi-disciplinary knowledge and tends to be mundane, tedious, time consuming, practical and valuing cost-effectiveness. In contrast, as the mandate of a research institute is focused more on scientific standards and rigor than practicality, most

¹⁴ Engle, C.R. & Stone, N.M. 1989. A review of extension methodologies in aquaculture. Rome, UNDP/FAO, ADCP/REP/89/44:65 Pp.

¹⁵ See the reference in footnote 2.

¹⁶ Jahan, K.M., Beveridge, M.C.M. & Brooks, A.C. 2008. "Impact of long-term training support on small-scale carp polyculture farms of Bangladesh". *Journal of the World Aquaculture Society* 39: 441–453.

¹⁷ Hoffmann, V., Probst, K. & Christinck, A. 2007. Farmers and researchers: How can collaborative advantages be created in participatory research and technology development? *Agric Hum Values* 24: 355. doi:10.1007/s10460-007-9072-2

research tends to be specialized and favour technically challenging, academically intriguing topics instead of practical solutions to farmers.

36. To bridge the gaps, research funding and promotion criteria in academic communities should be modified or redesigned to motivate researchers to shift their attention, to some extent, from academic value towards practical use and their effort from pushing literature frontiers to solving real world problems. This may require funding sources to emphasize extension applicability in their criteria for proposal selection.

37. Efforts should be made to reframe real world problems into research topics attractive to researchers. This entails breaking a complex, multi-disciplinary, real-world problem into well-defined research questions. Ordinary extension workers may not have capacities to do this. Full-time or part-time extension staff in research institutes, such as extension specialists in a land- or sea-grant university in the United States, could serve as a nexus between extension workers and researchers.

38. Linkages between research and extension could be strengthened by more interactions between extensionists and researchers through various platforms or mechanisms (e.g. conferences, workshops, seminars, training courses, etc.). Students, especially graduate students, should be exposed more to reality and guided towards solving real world problems. Field-level internships with the intent of orienting students' research towards farmer-relevant problems in the real world could serve a role in bridging between research and extension.

39. There is also an opportunity for knowledge generated by farmers to be communicated to the research institutions, thereby reinforcing a two-directional flow of information. For example, a key component of the Farmer Field School approach is farmer-led research, and while the results are not meant to be statistically powerful, these results could better inform the research institutions who could then repeat experiments with higher sample sizes and more rigorous control variables. Extension agents could serve as the intermediaries, reporting the results of farmer trials to the relevant research institutions.

Improving the quality and effectiveness of extension instruments and materials

40. Extension services can be provided through conferences, workshops, seminars, forums, training courses, technical networks (e.g. SARNISSA), demonstration farms, field visits, study tours, etc. Instruments used in extension include technical manuals, booklets, leaflets, brochures, posters, flipcharts, presentations, radios, videos, etc. The use of short video clips taken with mobile phones and shared by extension workers in local language through social media can be an excellent tool both for empowering decentralized extension staff as well as sharing examples of good practices quickly and widely. Access to Knowledge Sharing Platforms has the potential to allow developing countries jump over the challenges of more traditional extension systems. The rapid development of mobile communications is a real "game changer" for agricultural extension, but requires user-friendly platforms to leverage this for agricultural development.

41. Advancements in Information Communication and Technology allow more cost-effective extension methods. For example, experts can be invited to host a forum on the internet answering the questions raised by farmer participants; pictures can be sent to distant fish disease experts for diagnosis and advice; and so on.

42. Leaflets, booklets, brochures and other printed materials are the most commonly used extension materials. Pictorial and visual materials (e.g. pictures, posts and videos) tend to be more efficient and effective in communicating knowledge than text-based sources. Materials should be jointly designed by extension agents and farmers, produced in local languages, and distributed widely in order to reach as large a portion of the target audience as possible.

43. Ill-considered or unsuitable extension materials can cause confusion or lead to misunderstanding; pre-testing with target groups is essential before wide dissemination. For example,

cartoons, which are considered in some cultures an innovative way to communicate, may be seen as condescending in other cultures.¹⁸ A pre-testing process should help identify potential confusion and misunderstanding and find out the reasons why extension materials are unclear or ineffective. Feedback from pre-testing should be used to improve the materials until they communicate the knowledge effectively.

Facilitating private sector extension

44. Key actors on the aquaculture value chain, be it feed or seed suppliers, fish traders or processing plants, have incentives to provide extension, credits and other support to fish farmers whose performance affects their businesses. With close connection with farmers on a regular basis, such key actors, if trusted by farmers, are ideal focal points for dissemination of knowledge and skills. Capacity building on such key actors would tend to enhance the efficiency and effectiveness of the trickle down modality.

45. However, these actors may be very sub-sector specific and only provide specific extension services (e.g. feed suppliers focusing on feed management) to a specific group of farmers (i.e. the buyers of their products or services). In addition, seemingly free services may have hidden costs (e.g. feed suppliers that provide extension services charging higher feed price) and could be biased (e.g. feed suppliers promoting feed-intensive technologies that maximize feed use instead of farmers' profit).

46. In Africa, where the young aquaculture sector relies heavily on private service providers for extension services, there have been concerns over the capacity and competency of self-declared aquaculture consultants and the quality of their extension services.¹⁹ Government can adopt various mechanisms to improve the capacity of private service providers, such as training-of-trainers, licensing professional aquaculture consultants, or facilitating the establishment of aquaculture specialist associations.

47. Farmer-to-farmer extension has the advantage of integrating new technologies into the indigenous knowledge of farmers. One constraint is that core farmers may not be able to pass on knowledge and skills effectively to heterogeneous fellow farmers according to their specific conditions and needs. Technologies fit for progressive farmers may not be suitable for resource poor farmers. Also, farmers may be unwilling to share knowledge and skills for fear of creating competition. Their interest and dedication to farmer-to-farmer extension may diminish as their growing business requires more attention from them. Success stories of farmer-to-farmer extension could be used to ease core farmers' concerns that educating fellow farmers would be a self-destructing effort that creates competition.

48. The FFS approach to extension was originally developed by FAO in the late 1980s²⁰ and has become a popular modality for organized farmer-to-farmer extension widely used by IGOs and NGOs in over 90 countries.²¹ Based on people-centred learning, this approach uses participatory methods to create a learning environment where the participants have the opportunity to learn in a risk-free setting²² facilitated by a local trainer, through direct observation, discussion and decision-making in practical field exercises over an entire growing season, thereby learning-by-doing. The field/pond is the school, where traditional, current and innovative methods are tested and integrated, in the context of local ecosystem, using a shared problem as the entry point for group work. FFS have been used for a range of technical problems, including aquaculture development, business development and youth

¹⁸ Albrecht, H., Bergmann, H., Diederich, G., Großer, E., Hoffmann, V., Keller, P., Payr G. & Sülzer, R. 1989. *Agricultural Extension. Vol. 1, Basic Concepts and Methods*. Rural Development Series. Eschborn, Germany: GTZ and Wageningen, The Netherlands: CTA.

¹⁹ Rutaisire, J., Charo-Karisa, H., Shoko, A.P. & Nyandat, B. 2009. Aquaculture for increased fish production in East Africa". *African Journal of Tropical Hydrobiology and Fisheries* 12: 74-77.

²⁰ FAO. 2007. *Global Farmer Field School Platform*. <http://www.fao.org/farmer-field-schools/en/>.

²¹ FAO. 2016. *Farmer Field School Guidance Document – Planning for quality programmes*. Rome, Italy. www.fao.org/3/a-i5296e.pdf

²² Instead of learning from own mistakes which could be costly.

employment, and have proved to strengthen not only technical skills, but also to significantly strengthen community and household relationships.

49. However, there are concerns that as FFS requires the farmers' commitment to be physically present in the field for long periods for a specific topic, it may not always be a cost-effective approach. Therefore, over-promotion of the approach may compromise other equally or more suitable methods.²³

Credit as a facilitator of extension

50. Feed suppliers provide extension services on feed management so that farmers can purchase and properly use their products. Similarly, in order for farmers to adopt good practices in feed management, extension agencies may need to help them obtain feed. Extension agencies usually do not provide farming materials to farmers but can help them access credit to buy them. This requires coordination among fish farmers, extension agencies and financial institutes. Many NGOs organize farmer groups through microcredit schemes, which enables them to provide more effective extension services through access to inputs.

51. Aquaculture is generally deemed a high-risk business by financial communities, which leads to a reluctance to offer credit, loans and insurance with reasonable interest or premium rates. Integrating lending agencies into aquaculture extension would enhance their understanding of the sector and strengthen their confidence in farmers who are guided and supported by extension agencies.

More extension on the economic or financial performance of aquaculture

52. In aquaculture training courses or manuals, financial analysis and business planning is often a secondary consideration to the technical aspects. As a result, production maximization has often been advocated by extensionists and accepted by farmers, explicitly or implicitly, as the goal of fish farming; whereas profit maximization, with environmental and social costs properly accounted for, should be the ultimate goal of aquaculture as a business.

53. Research interests show a similar tendency to deemphasize the importance of economic or financial performance in favour of technically challenging topics (e.g. increase stocking density for higher yield) which does not offer a complete picture of the aquaculture industry. Efforts to improve technical performance only through production expansion or intensification may have negative results such as market glut, price collapse and overall financial loss.

Strategy and plan on aquaculture extension

54. A strategy and plan for aquaculture extension and human resource development is a key component for high-impact aquaculture and integrated agriculture-aquaculture development. It could be a stand-alone strategy and plan, part of a general agricultural extension strategy and plan, or embedded in an aquaculture sector/Blue Growth Initiative development strategy and plan.

55. A strategy and plan for aquaculture extension should be based on in-depth understanding of the sector's human resource requirements at different development stages, potential means of human capital formation, and the roles of key actors (government, IGOs, NGOs, research institutes and the private sector) in the process.

56. An aquaculture human resource development strategy and plan would not only guide government's efforts in aquaculture extension but also help other extension providers align their activities for more coordinated aquaculture extension.

²³ See the reference in footnote 1.

FAO'S ROLES IN IMPROVING THE EFFICIENCY AND EFFECTIVENNES OF AQUACULTURE EXTENSION

57. FAO promotes the capacity development approach²⁴ providing technical and policy assistance to Members on a wide range of opportunities and challenges to enhance capacities and competencies at policy levels (enabling environments), organizational levels (supporting institutions building) and at the individual level (trainees, agents of action, stakeholders, etc.).

58. Capacity building is a crucial component of most of FAO's projects on aquaculture including integrated agriculture-aquaculture development. FAO provides or contributes to extension services on different subjects (e.g. on good shrimp aquaculture practices,²⁵ aquaculture feed manufacturing practice,²⁶ fish disease and biosecurity, conducting aquaculture as a business, etc.), and through different approaches. Some interventions target primarily core farmers and extension workers, through training courses, workshops, study tours, field visits and other activities, while other interventions support the FFS approach to participatory education through season-long field based activities, aiming to facilitate experimentation and problem solving, leading to learning through direct experience.

59. In recent years FAO has conducted a series of training workshops on “conducting aquaculture as a business”, primarily in Africa, under various national and regional projects.²⁷ These workshops aim to improve farmers' skills in business planning and financial management. In a recent sub-regional training workshop in Eastern Africa,²⁸ technical and business trainings are integrated to provide farmers with a more complete skill sets.

60. FAO can improve its support to extension services by promoting less top-down and more participatory work both in project design and implementation. Increasing efforts in following up the trickling down effects, better coordination among its various projects, and enhanced collaboration with other government or non-government extension entities are among other factors that would enhance the efficiency and effectiveness of the organization's efforts in aquaculture extension.

61. FAO generates and disseminates knowledge and experiences through technical papers, guidelines, manuals, factsheets and other publications. FAO develops tools or models to help improve technical and economic performance of aquaculture. A user-friendly investment tool developed by FAO has been used in the business training workshops mentioned above to help farmers conduct profitability analysis and business planning.²⁹

²⁴ FAO. 2017. FAO Capacity Development. Rome, Italy. <http://www.fao.org/capacity-development/en/>

²⁵ ADB/ACIAR/AwF/BRR/DKP/FAO/GTZ/IFC/MMAF/NACA/WWF. 2007. Practical manual on better management practices for tambak farming in Aceh. Published by Asian Development Bank ETESP, Australian Centre for International Agriculture Research, Food and Agriculture Organization of the United Nations, International Finance Corporation of the World Bank Group, Banda Aceh. June 2007. http://library.enaca.org/Shrimp/publications/e014_bmp_book_english.pdf

²⁶ FAO. 2001. Aquaculture development. 1. Good aquaculture feed manufacturing practice. FAO Technical Guidelines for Responsible Fisheries. No. 5, Suppl. 1. Rome, FAO. www.fao.org/3/a-y1453e.pdf

²⁷ FAO. 2012. FAO-Government of Uganda capacity building workshop on conducting aquaculture as a business under the SMARTFISH project. FAO Aquaculture Newsletter 50 (December 2012). pp. 14–15.

²⁸ FAO. 2017. Sub-Regional Training Workshop on Doing Aquaculture as a Business. *FAO Aquaculture Newsletter No. 56*. Available at: www.fao.org/3/a-i7171e.pdf. Rome, FAO.

²⁹ A beta version of the “User-Friendly Tool for Investment Decision Making in Aquaculture” will be shortly released online.

62. A bio-economic model on tilapia farming has recently been developed by FAO and research partners in China.³⁰ The model reveals great potential to improve the technical and economic performance of aquaculture through optimizing farming arrangements and practices according to different climate, technical and economic conditions. The bio-economic modelling approach can be used to develop tailor-made, user-friendly tools to help farmers make decisions according to different conditions.

63. As a knowledge organization, FAO can serve as a bridge between research, extension and farmer communities. With close interactions with farmers through various field projects and a highly educated, multi-disciplinary team of professionals (be it FAO professional staff or its consultants), FAO can play a major role in channelling research efforts into solving real world problems. FAO has a corporate policy to designate institutions that provide specific, independent technical/scientific advice on issues related to FAO's mandate as "FAO Reference Centres".³¹ For example, in 2014, FFRC of the Chinese Academy of Fishery Sciences (CAFS) was designated as a "FAO Reference Centre for Aquaculture and Inland Fisheries Research and Training".³²

64. Through its regional, sub-regional and national offices, FAO has been for many years the main gateway for many countries to the international aquaculture community. Importantly, FAO has helped establish regional or sub-regional networks such as NACA, Network of Aquaculture of the Americas (RAA), Aquaculture Network for Africa (ANAF), Network of Aquaculture Centres of Eastern Europe (NACEE) and Micronesian Association for Sustainable Aquaculture (MASA). With these assets, FAO could continue to serve as an international independent facilitator in stimulating wider inter-regional collaboration among aquaculture institutions and organizations in the area of aquaculture extension.

65. FAO South-South Cooperation Programmes offer a myriad of aquaculture development solutions, including facilitating dialogue between international actors; providing a framework for cooperation within which exchanges can take place among countries, institutions, cooperatives and organizations; and mobilizing experts and resources. One common modality is the exchange of technical expertise, from short-term (e.g. 6 months) to long-term (e.g. 2 to 3 years), consisting of deployment of experts from an aquaculture advanced country to a recipient country. Further modalities include study tours and exchange visits, as well as specific training courses. As a facilitator of South-South Cooperation, FAO brings together countries that have development solutions with countries that are also interested in applying them.

66. Subject to available financial and human resources, FAO can organize conferences, workshops, forums and other activities to facilitate exchange of information and experience in aquaculture extension. FAO can compile, translate and synthesize knowledge and information products (e.g. technical manuals, videos, etc.) for global dissemination.

67. Through its TCP Programme, SSC and other related mechanisms, FAO will continue to provide technical assistance to Members regarding the development of aquaculture extension strategies and plans. FAO has activities on decent employment³³ and human resource profiling³⁴ in fisheries and

³⁰ FAO. 2017. Improving the Technical and Economic Performance of Tilapia Farming under Climate Variation from a Bio-Economic Modelling Perspective. *FAO Aquaculture Newsletter No. 56*. Available at: www.fao.org/3/a-i7171e.pdf. Rome, FAO.

³¹ FAO. 2012. FAO Reference Center. In EMPRES Transboundary Animal Diseases Bulletin 40: 28–30. Rome, Italy. www.fao.org/docrep/015/i2811e/i2811e.pdf

³² FAO. 2016. Report of the International High-Level Consultative Expert Workshop (HLCEW) on Sustainable Development of Aquaculture and Inland Fisheries, Wuxi, Jiangsu Province, China, 1–5 June 2015. FAO Fisheries and Aquaculture Report 1129. Rome, Italy. www.fao.org/3/a-i5146e.pdf

³³ FAO. 2016. Scoping study on decent work and employment in fisheries and aquaculture: Issues and actions for discussion and programming. Rome, Italy. www.fao.org/3/a-i5980e.pdf

³⁴ FAO has an ongoing pilot study on human resource profiling in China's aquaculture and fisheries; the results are forthcoming in 2018.

aquaculture to facilitate in-depth understanding of human resource requirements of aquaculture at different stages, which is needed for proper planning of aquaculture extension.

GUIDANCE SOUGHT

68. **The Sub-Committee is requested to:**

- comment on the information presented in this document;
- share experiences and lessons learned in aquaculture extension;
- recommend actions and activities towards improving the efficiency and effectiveness of aquaculture extension.