Training course packages targeting food operators on the adoption and management of the technological innovations

AQUACULTURE SYSTEMS

Introduction to improved fish farming

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Table of Contents

1. FoodLAND technical innovation for local food supply chains: concepts and approaches

The FoodLAND project has the ambition to impact on a large number of supply chains and communities, hence the process of food operators' capacity development has to be tailored and as much participative as possible. Accordingly, one of the assumptions of FoodLAND is that sustainable and nutrition-responsive farming systems can be achieved basically by strengthening the capacity development, and specifically by **a)** empowering farmers and processors through the implementation of capacity building processes and concrete opportunities; **b)** creating or consolidating cooperation and shared knowledge to overcome the lack of coordination among food operators; **c)** addressing the inefficient use of resources; **d)** trying to address and build resiliency to the high vulnerability of food systems to climate change; **e)** enhancing the integration of supply chains by creating commercial and stakeholders' networks; **f)** improving the responsiveness of the production sector to the market demand.

To implement these elements of capacity development, FoodLAND proposed the adoption of specific innovations, among which the organizational ones, to create strong and responsive links between producers and encompassing all the intermediate actors along the food value chain, such as researchers, SMEs, NGOs, local and national authorities. In order to ease the creation of those links and guarantee the sustainability over time of the results, 14 Food Hubs will be created in 6 countries as part of the organizational innovations. Food Hubs are conceived as multi-actors centers of innovation where to develop or enhance the organizational and operational conditions enabling local food supply chains (D3.6).

Functional to the implementation of the Food Hubs and of the innovations, the training courses were designed – in form of capacity development activities – as a two-phase process. Firstly, a training session focused on general, preparatory topics was provided to farmers as described and reported in D3.5 ("Group Introductory Training", GIT). According to the project GA, GIT broad set of goals

were: to enhance the knowledge of consumers' nutritional needs and market opportunities, and to boost the notions about climate change, sustainability, resilience, and food culture. Secondly, a specific training session were organized to provide food operators with practical information on the adoption and management of the innovations tested at lab / small scale level and to contribute to validating them at appropriate scale.

However, as the whole approach has been designed by FoodLAND to ensure the inclusion of the local actors from the first moment, both the training sessions were set up accordingly. Indeed, yet in the inception phase of the project, an assessment on participatory methods has been run and Participatory Learning and Action (PLA) approach has been eventually assessed as the best one to ensure the inclusion of multiple perspectives. The main purpose of PLA is to support people within communities to analyze their own situation, rather than have it analyzed by outsiders, and to ensure that any learning is then translated into action (Gosling and Edwards 2003). In addition, a gender-sensitive approach has been applied to the trainings that have been designed considering gender roles and power relations; they have provided equal opportunities to participate in the process by caring to times, venues and use of local languages.

The GITs have been conceived as the first step towards the innovation validation and aim at involving the producers, yet from the inception phase. They are just the first step in a sequence of 6, summed up in **Table 1**. After the GITs, where farmers and processors meet and share their vision and goals for the Food Hubs and exchange information about specific topics, the Food Hubs were created and the innovation tested (first in pre-test, then in pilot phase). The constant iteration between researchers and local actors is a key feature of the project: specifically, the practical trainings focused the single innovations (step 5) are aimed at validating the innovations at adequate scale and planned to trigger feedback loops of control and improvement involving developers and adopters.

Table 1. Activities with farmers and food processors (SMEs) and participatory approach

Step	1	2	3	4	5	6
Task	**T3.3**	**T3.3**	**T3.4**	**T4.1¸T4.5**	**T5.1¸T5.5**	**T5.1¸T5.5**
Activity	Group introductory training	Food Hubs creation	Innovation undertaking	Innovation tests	Individual and group practical training	Innovation pilot and validation

2. FoodLAND practical training: aims and scope

According to the project bottom-up and participatory approaches, following the courses on introductory topics GIT organized in the early project phase (T3.3), and as component creating / strengthening the Food Hubs as local innovation centres, FoodLAND has organized a second set of training activities with food operators based on active learning methods and gender equality principle (Task 5.1-5.9). In this regard, specific mechanisms (being aware of the gender roles and power relations; providing equal opportunities to participate in the process by putting attention to the times, venues, use of local languages, etc.) will be lifted to ensure women's participation. These training packages are aimed at providing the local farmers and food processors with operational instructions on the adoption and management of the validated innovations.

This second set of training activities has been organised – triggering PLA approach – as individual and group practical (demonstration/capacity building) activities to be conducted in parallel to the implementation of the technological research (where relevant) and of the innovation pilots and validation. These technology-centred trainings aim at strengthening the participants' understanding of novel production and post-harvest techniques, innovative tools and systems (e.g., climate smart/precision agriculture, hydroponics, and integrated aquaculture), new technologies for primary and secondary processing, and supply chain management. Thus they aim at fostering knowledge and operational capacity to deploy, manage, and maintain the validated technological innovations – documented by the released guidelines D4.1 ÷ D4.11 (e.g., training pamphlets, user manuals, flow diagrams, and operational recommendations) and practice abstracts D6.5 – validated jointly at appropriate scale.

3. Second training packages on the adoption and management of the tested innovations: an overview

The second training course aimed at consolidating the food operators' knowledge and practical skills to adopt, manage and validate the project innovations and complement the related guidelines. Specifically, the realized training materials provide local farmers and food operators with a set of notions and concrete information on a series of innovative tools and systems as per the following **Table 2**. It is clear that both the contents and formats of the learning packages widely differ across technologies as well as Food Hubs (when the same type of innovation must be validated in different contexts). The diversity that emerges from the proposed solutions reflects the different needs highlighted by farmers and stakeholders as well as the conditions and opportunities characterizing the local communities. Nevertheless, in order to take into due account the existing heterogeneity inside the local communities, the developed learning materials have been let available on the project intranet so as to be used for further training initiatives across the network of Food Hubs.

4. Second training packages on practical information on the adoption and management of the tested innovations

Aquaculture systems

Introduction to improved fish farming

What is aquaculture?

Aquaculture is the art and science of controlled rearing of finfish and other aquatic animals such as shrimps, lobster, oyster and crabs, under controlled or semi-controlled aquatic environment such as ponds, concrete tanks, plastic tanks and some natural water bodies.

Unlike fish that grow in natural water bodies without human interference, in aquaculture, feeding, fertilization, stocking, reproduction and harvesting are controlled.

Where aquaculture can be practiced?

Aquaculture can be practised in freshwater, brackish water and marine water. In these ecological systems, aquaculture can take place in the natural environment or in an artificial setting.

Types of production systems

Ponds

Most of the aquaculture operations are conducted in ponds with sloping earthen levees and earthen bottoms (Figures 1,2,3).

Figure 1. Earthen ponds

Figure 2. Hapas installed in a pond

Figure 3. Earthen ponds fitted with pond liners

Concrete and plastic tanks

Figure 4. Concrete tanks

Figure 5. Concrete tanks

Figure 6. Plastic tanks

Raceways

Raceways are culture units in which water continuously flows (Figure 7).

Figure 7. Raceway

Cages

Cages are floating or submerged units that are placed in open water, such as a lake, reservoir, river and ocean. Cages are sometimes used in large ponds that cannot be drained (Figure 9).

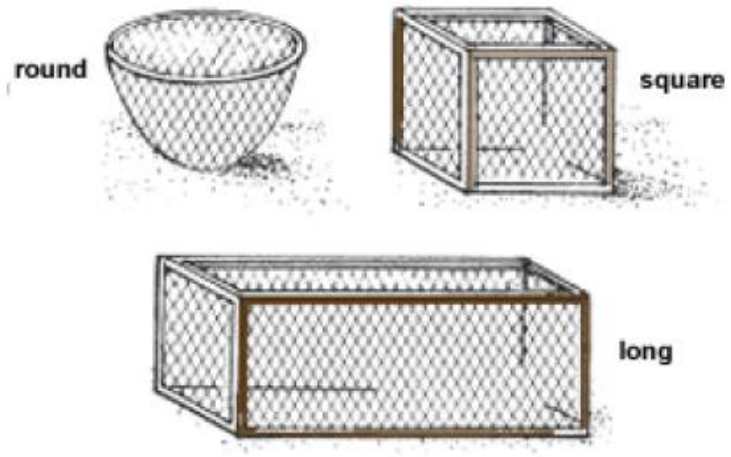
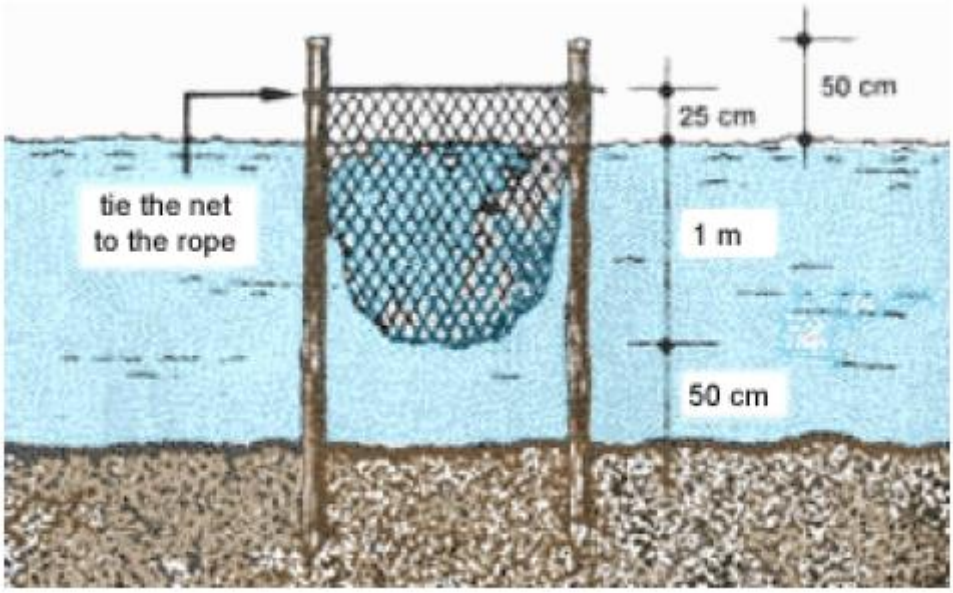


Figure 8. Different types of cages



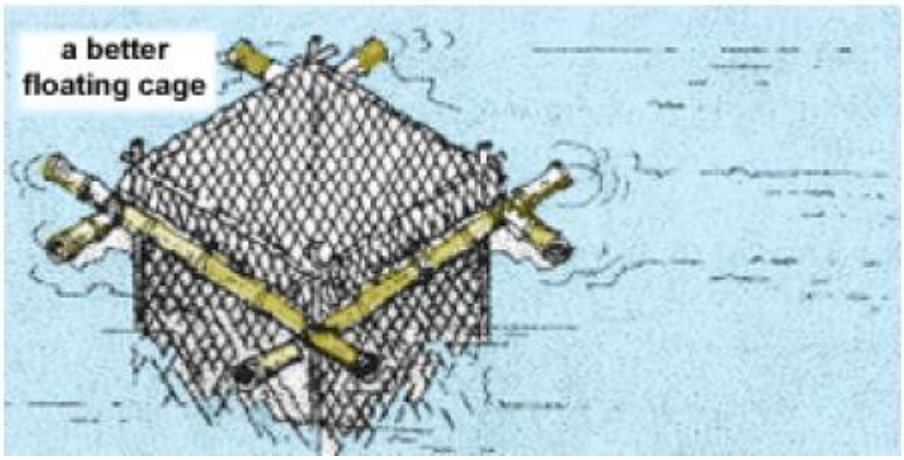


Figure 9. Cages installed in water

Recirculating systems

Recirculating aquaculture system (RAS) is a culture unit in which a portion (or all) of the water used to raise fish is filtered to restore water quality and then recycled back to the culture chambers (Figure 10).

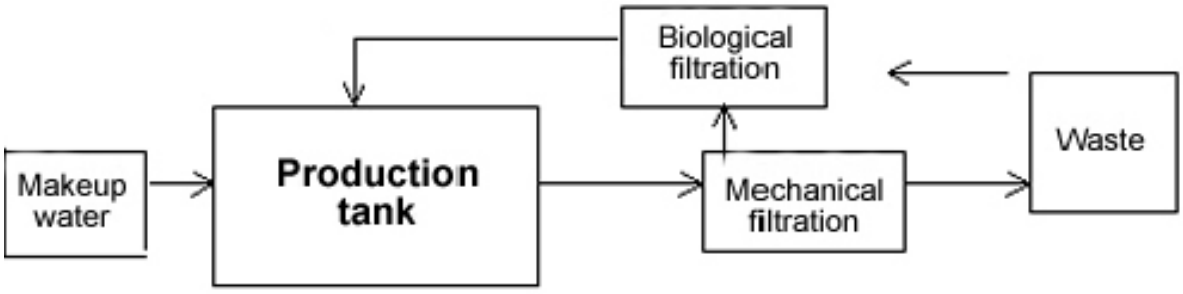


Figure 10. Diagram for recirculating aquaculture system

Why practice aquaculture?

To get animal protein food for the family and keep the family strong and healthier.
To generate household income and improve a family's life.
To provide a source of employment for the members of the family.
Aquaculture can contribute towards eradication of hunger, food insecurity and malnutrition.

Species cultured in Tanzania

Species culture in freshwater

Tilapia species: the most common is Nile tilapia (Oreochromis niloticus). Other farmed tilapias are Wami tilapia (Oreochromis urolepis hornorum), Rufiji tilapia (Oreochromis urolepis urolepis) and Mozambique tilapia (Oreochromis mossambicus).
North African catfish (Clarias gariepinus).

Species cultured in marine waters

Seaweeds (Eucheuma spinosum and Echeuma cottonii),
Milkfish (Chanos chanos) and
Prawns
Pearl oysters
Crabs

Factors to consider when choosing species to culture

Growth rate and production level under culture condition.
Ability to breed easily under captive conditions.
Ability to feed on natural food and inexpensive supplementary feeds.
The size and age at first maturity.
Consumer acceptance and availability of markets for the species.

Types of culture systems

Monoculture: Culture systems involving the production of one species in a pond or tank, e.g. culturing only Nile tilapia in a pond.

Polyculture: Culture system that involve the culture of more than one species of fish in the same pond, for example, culturing Nile tilapia and African catfish, with each species using a different food source.
Integrated fish culture: A system of producing fish in combination with crop production and/or livestock keeping around the fish pond e.g. fish farming, vegetable and chicken production. The enterprises are linked in such a way that the wastes/by-products of one enterprise become inputs to the other enterprise.

Types of farming systems

Extensive system

No nutritional inputs (fertilizers and feeds) are applied in the pond. The cultured fish depends solely on natural food available in the pond.
Low stocking density
Low production costs
Low fish production

Semi-intensive system

Manure is applied in the ponds to increase production of natural food and a small amount of supplementary feed is provided.
Moderate stocking density
Relatively higher fish production compared to the extensive system
Moderate production cost

Intensive system

Total nutritional requirements of culture fish are met by application of high quality formulated diets.
Replenishment, aeration or recirculation of water in the culture unit in order to maintain good water quality and enrich in oxygen.
High stocking density
High fish production per unit area
High production cost

Factors to consider before starting fish farming

Availability of suitable land area which is not prone to flooding
Reliable water supply: quantity and quality of water should be adequate to support production throughout the year or production cycle.
Availability of production inputs such as fingerlings of desired species, fish feeds and fertilizers
Availability of extension services and technical advices
Infrastructure such as roads and electricity
Availability of market for the farmed fish species
Presence and competition from other fish farmers
Legal issues that can affect fish farming at the farm such as Land use Act, Water use Act and Environmental Management Act.

Good practices for fish farming

Use land area for pond construction that is relatively level (a slope of about 1% is ideal). Steeply sloped land area is not suitable for pond construction.
The area should be large enough for your plans and located close to a living house. The pond size should be at least 300 m^2.
Use water source for fish ponds that is reliable with water of good quality and without any fish or predators in it.

Make sure that the fish pond has adequate water of good quality throughout the culture cycle.
Fertilize fish ponds using the appropriate amount of fertilizer per unit area.
Make sure that the pond water has greenish colour.
Get fingerlings from a reliable hatchery or any other source.
Use appropriate stocking density to stock the fish in ponds.
Provide the cultured fish with supplementary feed of good quality and feed at least two times per day.
Clean pond dikes and remove weeds and other undesirable plants from the fish ponds very often.
Prevent predators (birds, frogs, tortoise, snakes, etc) that can eat or damage the fish in the ponds.
People should not wash clothes and domestic utensils or take bath in the ponds.
Check fish ponds every day at least two times per day, in the morning and evening.
Keep records for all important activities at the fish farm.
Harvest fish when they attain the right age and weight according to the market requirements.
Remember that fish productivity depends on the quality of water, fingerlings and feed.