Small-scale aquaculture in rural development

Abdel Rahman El Gamal, PhD
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Commercial aquaculture is and will remain the principal producing system (in tonnage)

In situations where commercial aquaculture does not exist, the small-scale aquaculture can be of great benefit to many families

Some social elements are usually overlooked in commercial aquaculture (e.g. mal-nutrition, un-employment, gender issues)

Over-looked issues could be addressed in small-scale aquaculture

Fish of good quality and affordable prices will always be needed in rural areas where income is usually low and fish is at high demand
Fish and livelihood

It is not necessarily that fish in this case is of premium size of neatly packed but should be of top quality.

This little boy would be happier with small fish than a bigger piece of larger fish.

Mother deguts harvested fish from a fish farm in the Asuogyaman District of Ghana.

Credit: Patrick Appenteng (Ghana)
There are successful models of small-scale aquaculture (e.g. backyard hatchery for freshwater prawn in Thailand during 1980s).

Promoting family aquaculture is justifiable for incorporating fish as a good source of animal protein in family meal.

Aquaculture has been incorporated in rural development programs either as a sole activity or in integration with other agricultural activities.
Low income people may not be able to afford cash expenses even in small amounts.

If the lack of cash is coupled with difficulties in accessing credits, it turns to a solid barrier to sustaining small aquaculture projects.

Sharing physical labor among farmers is a means to overcome a part of cash problem.
Although the definitions of rural aquaculture projects vary, they have something in common:

- Simple with social dimensions
- Caring more about low-income communities
- Family demand of food fish is always met while **extra fish** is sold. If this is not the case, a social problem must be there
- Ornamental fish projects are an example of cash crops of small-scale aquaculture
Features of rural aquaculture - Labor involvement

- Small projects are constructed with less or no machinery and more labor.
- Family may carry out part/most of farming practices
- Some family members (e.g. women) can work in family projects but will not accept to work for others
- Women’s role can exceed feed preparation or hapa making to pond management

Photos' Credit: Gabriel de Labra (Spain)
Vulnerability of small-scale beneficiaries

Small holders in rural areas are often vulnerable in many aspects:

- Limited access to natural resources and often lose competition
- Limited capacity to cope with crisis situations and risks
- Mostly prefer livelihood opportunities with less perceived risks
- Limited ability to meet specific requirements for technology adoption – probably due to low literacy levels
- Hesitant to try but may apply what was found successful in their neighborhood
- Limited access to aid programs which could have been designed for them (e.g. credit)
Species criteria for small-scale aquaculture

- Farmers can deal with in ease
- Does not require neither exceptional skills or sophisticated husbandry arrangements
- For quick turn over, it is preferred to use fish species that have short generations
- Above all, the species should be widely accepted by target consumers

Credit: Eudes E. Sanchez (Colombia)
### Advantages

- Do not pose environmental threats to biodiversity, disease, etc.
- Known as a species and ways of preparation to local people
- Broodstock/fingerlings – when needed - can be obtained from natural waters
- **Theoretically**, its reproduction and husbandry is known at local level

### Disadvantages

Often native species did not receive enough attention from NARS. This led to:

- Reproduction technology and seed production is often not well developed
- Not performing any genetic programs and so selected strains do not exist
- Absence of reliable data on its performance in aquaculture

NARS: National Agricultural Research System
The wrong choice: Golden Apply Snail

- A Big campaign to Introduce it to feed poor rice farmers in Asia. (came from Argentine in 1980 to Taiwan then to Asian countries).
  - Farmers (target beneficiaries) did not like it: **Top-bottom planning**
  - Began to infest rice fields and prey on little rice plants (7-15 days old) causing significant losses
Golden apple snail (GAS) in rice paddies
(a useful case study)

- Has invested about 800,000 ha of rice in the Philippines in 1995
- In Vietnam, GAS invested about 110,000 ha of rice paddies in 1997. In some parts of “Thua Thein Hue” province, rice farmers had to reseed rice several times

A bigger campaign to get rid of it
Models of small-scale aquaculture systems

- Rice – fish culture
- Manure systems (ducks – chicken - rabbits)
- Cages
Rice-fish culture (features)

- Not a new practice to most rice farmers
- Low-risk technology
- Minimum skill will be sufficient
- Very low investment required if any (ditch & screen)
- Minimum conflicts with other farm activities – if any

As rice is the main crop, fish has to cope with rice requirements & practices and never vise versa
Rice - fish aquaculture - Benefits

- About 5-15% increases of rice production
- Fish can control algae and soft plants and their seeds and hence reduce the need for algaecides
- Control mosquito larvae and snails
- Consume rice insects (e.g. brown plant hopper)
- Higher net revenue due to the saving on fertilizers and pesticides
- Harvested fish when consumed, supports fish consumption of families (even seasonal)
Fish species in rice fields – Based on their:
(food habits – acceptance for consumption – adaptability to the system)
# Rice – fish culture (challenges and considerations)

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Considerations</th>
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| Harmonizing fish growth (production) with the calendar of the short season of rice strains | Proper choice of fish & size upon stocking  
Consider feeding  
Could target fingerlings rather than table fish |
| Shallowness of water and fluctuation of temperature & dissolved oxygen    | Construction of refugee ditch  
Proper selection of tolerant fish (e.g. air breathers, tilapia) |
| Possible applications with chemicals or pesticides                        | Rice varieties resistant to insects and disease  
Partly drain the field to guide fish to the ditch  
Change water after 3-4 days |
| Risk of grazing on rice seedlings or seeds                                 | Safe size of chosen species after rice is well established |
Fish-duck farming

Historic background
Has expanded rapidly in Central Europe after World War II to offset the shortage in animal protein.
Afterwards, the practice has expanded to Asia and beyond.
Suits rural development where ducks are traditionally consumed.
With the exception of France, most of duck consumption takes place in Asia.
Ducks are left on water surface for most of the day and sheltered during night.

Applications
Stocking density of ducks could be:
Low: in Germany, 300 ducks/ha led to 100 kg/ha of common carp.
High: in Hong Kong, ducks are stocked at 2500-3500/ha to yield 5 to 6 t/ha of meat and 2750-5640 kg/ha of fish.

What is the leading crop?

30 ducks are required to fertilize 1000-m² pond
14-m² duck shelter
Fish-duck farming

Benefits

- Fertilize water (non-labor manuring machines)
- Suppress the undesirable aquatic vegetation
- Water aeration through swimming (biological aerators)
- Pond water provides about 25% of duck’s diet (plants, insects, aquatic larvae, and earthworms)
- Loosen pond bottom and release soil nutrients (phosphorous)

Challenges

- Compatibility between warm-blooded birds and cold-blooded fish (system)
- Less value where ducks are not traditionally eaten
- Ducklings have to be grown somewhere till they can swim
Fish-chicken farming (Not water birds)

Chicken when raised in a shelter (0.5m above water level):
- Maximize the use of space
- Saves manuring labor  **OR**

Adjacent to the ponds; poultry excreta are recycled to fertilize the fishponds

Could be either for broilers or for laying hens

With few exceptions, the ratio between numbers of animals which suit specific aquaculture operations is based on personal experience

Credit: Emmanuel Godfrey and Mashaka (Tanzania)
Fish-chicken farming

Considerations

One-day chicks are nursed for at least 14 days before being used in this system.

Each broiler requires 1.5 ft² floor area; each layer requires 3 ft².

Enough cross ventilation should be maintained.

Floors should have 1 cm gap, to allow excreta to fall into the pond, but not to trap the chicken's feet.

Challenges

If water turns deep green due to plankton blooms, dissolved oxygen may get drop and could cause fish kill.

If this happens, plastic sheets are placed below the chicken shelter to prevent chicken excreta from reaching water.

Fish feeding may be suspended for enough time.

Refresh the pond with freshwater whenever possible.

Unless chicken treatment or vaccination is carried out in special facilities away from water, there will be always a chance for contaminating pond water with residues of drugs and chemicals.

Photo credit: Innocent Zambou (Cameroon)

Photo credit: Alain Murekambanze (Burundi)
Fish-chicken farming – Case study (Tanzania)

Description

- This farm is located at Tarime District in Mara Region, where temperature ranges from 20-25°C
- This practice has been benefited from a national study carried out in the district
- In order to implement this project, the participatory approach has been adopted in which fishery agency, research institutes and farmers worked together towards enhancing farm productivity and profitability
- In this type of integration, poultry rearing unit (chicken huts) are placed on the top of pond water where tilapia has been stocked. The chicken huts—in regard to laying hens— are furnished with wooden egg laying boxes (30 cm × 30 cm × 30 cm)
- Chicken feed is mixed on-farm using locally available feed ingredients.
- No supplemental feed is provided to fish throughout the culture period as the poultry droppings and spilled feed from poultry provided feed for the fish either directly or through enhancing water productivity.

Comments

Photo credit: Lucka Paschal and Erick Kiiza (Tanzania)

Notes: Issues considered
Benefitting from previous studies
Climatic conditions have been considered (for fish/birds)
Participatory approach has been adopted
Manageable approach rather that highest productions was found appropriate (e.g. feeding)
Rabbit-fish farming

- Field observations in Rwanda showed that 10 rabbits are sufficient to provide enough organic fertilization to 1-acre fish pond.

- The only source of fish nutrition in this system could be the natural food which is stimulated and maintained by the organic fertilization (rabbit excreta).

- Although rabbits are not traditionally eaten in many countries, there are significant national efforts to promote the consumption of rabbit meat which is low in fat, low in cholesterol and rich in proteins.

- This type of integration has a potential application in world rural development programs especially whereas rabbits are consumed.
Rabbit-fish farming

The advantages of the rabbit component in this integrated system include:

- High quality meat, short generation, high productivity, fast growth rate, and low production costs
- Rabbits being herbivores, they can utilize a variety of farm byproducts. Forage, cassava, and sweet potato vines are examples
- Job creation especially after some training

Highest rabbit meat consumption occurs in the Mediterranean Countries whereas Italy has the world lead in rabbit consumption (about 6 kg/capita/year)

Although there is no religious taboos against eating rabbit meat, in some cultures, rabbits are looked at as cute and fuzzy animals which initiates an aversion in many people to rabbit consumption.
Cage aquaculture

Benefits

- Ideal for landless people who get an access to water resources
- Could be used to produce table fish or fingerlings
- Investment cost is usually low
- Women can have an active role especially in feed preparation
- Ease of handling and harvesting

Challenges

- Compatibility with environmental standards
- Vulnerability to pouching if not properly secured
Marketing the extra produced fish

- Often marketed fish is in small quantities
- Small quantities lack bargaining capacity
- Often sold within the community or through middlemen
- Consumer believes in its freshness (they may witness the harvest)
- It is expected to be at affordable prices
- If difficulties in fish marketing is detected, a community fish market would help
- Direct marketing eliminates the traditional layers in marketing

Seaweed farming and marketing in Tanzania:
Seaweed farming was introduced in Tanzania in the early 1980s. Farmers are depending on their buyer company for the supply of seed, stakes, and ropes, so they have no negotiating power on price. So-far, sea weed is processed by women for soap making
Witnessing the harvest occurs only in rural region

This event provides the opportunity to small producers to sell their product without additional marketing expenses

Buyers can acquire truly fresh fish and usually at affordable prices

Credit: Herman Hennig (Argentine)

Credit: Domwa Mathieiu (Cameroon)
Planning & promoting small-scale aquaculture projects
Promoting small-scale aquaculture
Ensuring initial success

- Choose the appropriate technology
- Select target beneficiaries based on transparent criteria
- Choose the right species of fish
- Consider all production related issues (e.g. marketing)
- Ensure that activities meet existing regulations (e.g. environment, food safety)
- Develop a special credit line for the project
- Plan for project sustainability (afterwards)

These projects should not be subject to trials & errors

The use of quality fingerlings is of high priority to ensure that small-scale fish farmers are starting off their production cycles with the best quality stock.
Promoting small-scale aquaculture (approaches)

Top-bottom approach

- Planning is done by the central government "which knows better than beneficiaries" - theoretically
- This approach lacks the two-way information flow whereas only one side generates the information

GAS is an example

Participatory approach

- Participation of farmers, researchers and extension agents – all are winners
- Farmers adopt the outcomes of their own programs
- Success indicators include the number of active farmers, and the continuity of the program
- Extension agents act as catalysts and stimulate group efforts

The recent shift is towards greater farmer participation
Adoption curve and potential beneficiaries

Adoption Curve

2.5% Innovators
Early Adopters 13.5%
Early Majority 34%
Late Majority 34%
Laggards 16%

Source: Everett Rogers, Diffusion of Innovations, 5th Edition
### Adoption groups and potential beneficiaries

| Innovators: | Experienced, wealthier, brave & creative  
|            | Fond of developing and trying new ideas  
|            | Capable to take risk and can absorb some financial loss  
|            | If they fail, they quickly move forward to next innovation  
|            | Play a critical role in the early phase of the diffusion process. They pull the change from conventional methods which they normally do not appreciate. |
| Early adopters | Often educated with sufficient financial resources  
|              | Interested in trying new ideas proven successful somewhere.  
|              | Socially respected and opinion leaders  
|              | Their adoption to a given innovation eliminates most of the uncertainties  
|              | Reliable sources for quality information.  
|              | Ideal partners in field trials |
| Early majority | Rationalist, thoughtful and careful  
|               | Accept changes especially those tried by trusted sources such as early adopters  
|               | Prefer simple ideas and hate complexity  
|               | Avoid taking risks and prefer ideas of rapid payback periods |
| Late majority | Last portion to adopt an idea  
|                | Conservatives – skeptic – less resources  
|                | Use new ideas after seeing that most of people use it  
|                | Usually older, less educated and less wealthy  
|                | Their opinions are often shaky and could be changed by discouraging rumors and other opinions  
|                | They like to be absolutely sure then all of the uncertainties are removed before adopting a new idea. |
| Laggards | **Laggards:** Traditional people who resist the change  
|         | Comfortable with traditional practices  
|         | Suspicious, extremely cautious about new ideas which are felt risky  
|         | Like to be 100% sure that a new idea will not fail  
|         | If they finally adopt an innovation, it may already have been outdated  
|         | They may never adopt  
|         | Often older, with limited resources  
|         | Take very long time before making their minds |
Planning and threat assessment (case studies)

Fish cages in Kaptai Lake (Bangladesh)

**Project:** Promotion of fish cage farming of carps at Kaptai Lake

**Disaster:** Cyclones damaged fish cages, surviving cages experienced poor fish growth, and operators did not repair or replace damaged cages.

Careful planning should include risk assessment.

The analysis of stakeholders’ willingness and capacity to face such risks will be also needed.

Fish pens and cages in Laguna de Bay (Philippines)

**Project:** Promotion of fish pens and cages in Laguna de Bay

**Project aim:** Improve the socioeconomic conditions of small-scale fish farmers.

**Disaster:** In 1986 and 1987 the site was hit by two typhoons that damaged 95% of the fish pens and cages in the bay. The disaster left behind heavy losses and debt burdens on project beneficiaries.

In Mozambique where flooding as a consequence of cyclones is not uncommon, small-scale farmers are advised to set-up fish farms in flood-free areas.

**Source:** Asian Development Bank, 2004, Special evaluation study on small-scale freshwater rural aquaculture development for poverty reduction.
Simplicity concept and sustainability

By definition; these are simple projects

However; simplicity does not apply to the planning

Insisting on the use of poor quality farm inputs may lead to **unsustainable** projects

Simplicity concept is still based on scientific information and established technologies

2 million tilapia fry
Simplifying advanced technology
(Example: Aquaponic)

A simple version of hi-technology operations
It is very easy to operate, inexpensive, optimum for people with limited economic resources

Credit: Edwin Gómez Ramírez (Colombia)
Criteria and definitions: (family or small-scale aquaculture) – (Philippines)

Fish hatchery

- Production is less than 30,000 fingerlings/month
- Surface area is less than 1000 m²
- No ability to nursing fry
- Incomplete security regarding the area under utilization (via lease, partnerships and others)
- Vulnerable to the risk of flood/ or draught

Meeting three of the above means, the hatchery is a small one
Criteria and definitions: (family or small-scale aquaculture) – (Philippines)

Pond/ pen/cage farms

- Size
  - Earthen farm: size of each pond is less than 1000 m² in less than 1-ha farm
  - Pens: less than 1000 m²
  - Cages: less than 200 m²

- Financial resources are not sufficient. And no access to formal credit

- Quantity sold in cash does not exceed 30% of produced fish

- Utilization instability (lease/utilization) of land lack stability

- Water resources are either insufficient or seasonal

Meeting three of the above, the project is a small one
Criteria and definitions: (family or small-scale aquaculture) – (Malawi)

Integrating of aquaculture in agriculture systems (IAA). Most of criteria classifying small-scale farms included:

- Small land holding
- Low land productivity
- External inputs (such as new varieties, fertilizers and pesticides) are limited
- Credit is generally unavailable
- Fish consumption from family farms is a must
Notes on criteria

The criteria for small-scale beneficiaries which are considered in a country may not have the same weight or seen irrelevant in another country (e.g. flood, draught, etc.)

This requires site/country-specific criteria

A field surveys in Rwanda, indicated that fish farming provides cash to the family and supplements the diet of the Rwandan farmer.

Harvested food-sized fish:

- 61% were sold
- 31% were consumed by producers
- 8% were given away
Criteria of small-scale aquaculture
(Based on inputs provided by 15 specialists from 9 African countries)

- Small size, 10
- Easy to operate and maintain, 6
- Low production inputs, 5
- Minimum capital investment, 6
- Family consumption, 7
- Generate some income, 5
- Others, 13
Setting success indicators and identify requirements

Success indicators

- The sustainability of the projects beyond the end of the development programs is the most important indicator
- More reproductions of original projects
- Incidences of reaching beyond small-scale criteria (upgrading)

Requirements

Careful planning for the project, having in considerations:

- Small-scale beneficiaries do not have access to consultancy services (they may run simple assessment)
- Extension service is essential and should receive adequate support (budget, staff training)

Careful planning & securing project requirements eliminate unpleasant outcomes
Extension service and small-scale projects

General

Extension agents (trainers) should be well-trained themselves

Chosen trainers should have the ability to communicate with beneficiaries

Trainers should admit not knowing sometimes instead of giving wrong advices

If trainers lose the trust of farmers there might not be another chance

Challenges

Farmers do not trust agents who offer poor advice

Extension agents get readily discouraged if they are not accepted

Lead farmers could be selected to receive special training to enable transferring farming technology to fellow farmers (e.g. Bangladesh, China, Congo and Liberia)

Cultural issues should be identified and respected

Photo credit: Manuel Cano (Guatemala)

Photo credit: Kanwal Odhejo (Pakistan)
Challenges and issues of concern
Types of fish feed

Ranges from natural food (high in protein), to:
- Supplemental feed (low cost & high in energy), to:
- Specialized feed if technically and economically justified

Cost of feed will remain an important issue to consider in promoting rural aquaculture
Feed and small-scale aquaculture

Some of farm byproducts could be used while others **should not** be used.

Most farmed fish have difficulty in digesting plant materials.

Compost and/or silage improve the quality and digestibility of plant materials.

The use of external feed should be an option when economically feasible.

Some of usable farm byproducts have found to be useful in small-scale projects (e.g. yam/sweet potato leaves – duckweed).

*e.g.* Water hyacinth is not nutritionally balanced. The plant may be good for other usages but **NOT** as feed.
Some of usable farm byproducts in small-scale aquaculture

Yam/sweet potato leaves

- Around 95% of the world’s yams are grown in West Africa whereas Nigeria produces about 70% of world’s yam.
- China produces about 80% of total world production of sweet potato. In Africa, Uganda is the largest sweet potato producer.
- The nutritional merit of yam and/or sweet potato leaves recommended its use in animal feeding. Yam leaves are rich in vitamins A and C as well as riboflavin, fiber and iron.
- Sweet potato leaves contain as much as 27% protein on dry matter basis and is also rich in minerals and vitamins.
- A significant proportion of fish farmers in Uganda use the leaves of yam and/or sweet potato as a supplementary fish feed.
Good quality fry = good harvest

Reducing the production cost through giving-up the high quality fry should not be an option.

Fry costs are usually marginal when compared to other production inputs.

Small-scale aquaculture can use the best quality seed available.
Credit and small-scale aquaculture

To financial institutes, aquaculture is regarded as a relatively unknown business and hence is considered a risky activity.

Most small-scale fish farmers do not have the collateral as required by the commercial banks. some of which are very difficult or unrealistic (e.g. salary depositing; money against money).

Rural communities are not generally familiar with banking systems and often they do not enjoy credit history.

Some producers do not prefer bank credits as well as interests for personal beliefs.

Note: Supporting small-scale projects should be always the responsibility of governments and cannot be left to commercial banks.
Bank requirements are frequently not in favor of the landless, small-scale farmers and short lease cases.

Instead of banks, farmers may rely on informal credit from other sources, including suppliers’ credit.

**Supplier’s credit** made fish farmers to accept a modest quality fish feed. Interestingly, Farmers are often aware about that
Credit for small-scale projects (Egypt)

A credit line has launched in mid 1990s to provide soft loans to agricultural sectors including aquaculture.

Small/medium projects have been the immediate target to such credit line.

**Target groups:** not familiar with banking system, lack collaterals and no credit history.

Credit officers in collaborating banks were not familiar with aquaculture activities which were in their views a risky business.

Commercial companies were well-prepared for benefitting from the credit line.
Size of the small-scale aquaculture projects in governmental & aid programs

Increasing the number of beneficiaries could be done for political reasons. Although this may look a noble intention, it could threaten the sustainability of small-scale projects.

Beneficiaries may lose interest in case of under-sized projects.

Social studies are necessary for these small projects. Often, beneficiary are not aware or cannot afford feasibility studies.

It is more valuable to have fewer but successful projects than more of abandoned ones.
Small-scale aquaculture & family livelihood

Cages in Mymensingh River in Bangladesh

Aims to provide a protein rich food for families and to generate some income

Photo credit: Abu Sayed Talukder & Zahangir Alam (Bangladesh)

Small fish ponds in Thailand

The production goes first to family consumption while exceeded quantities—if occurred—could be exchanged with neighbors or sold

Photo credit: Worawut Koedprang (Thailand)

Small earthen ponds in Malawi

The outputs form an important part of household livelihoods

Photo credit: Gaves Mulaley (Malawi)
Small-scale aquaculture & production inputs

Integration with large animals in Rwanda

Ponds are owned by cooperative farmers in Nyagasambu site. The number of animals is sufficient to produce enough manure as required by the fish farm.

Photo credit: Emmanuel Hahirwasenga and Rwigiriza Augustin Kanimba (Rwanda)

Cages in Mymensingh River in Bangladesh

Fresh natural foods (e.g. duckweed, snails), household vegetable wastes, low cost feeds (e.g. rice bran and oilcake). In some cases, commercial feed could supplement the traditional feed.

Photo credit: Abu Sayed Talukder & Zahangir Alam (Bangladesh)

A program for small fish holders in Narino, Colombia

Fish feeds primarily on azolla while banana, yucca, bore are alternatives food sources.

Photo credit: Andres Delgado (Colombia)
Subsidies and support - Conflicting opinions

**Free production inputs**

Fish seed are the common free or subsidized inputs (e.g. sea bass in Thailand, common carp in Sri Lanka & Egypt and tilapia in Mexico)

Case studies showed that many aquaculture projects stopped immediately when subsidies discontinued (Thailand and Egypt)

In the launching phase, subsidy may be required. This should be done for a fixed period. Beneficiaries should know that ahead

**Technical/ economic tools**

Training is important for project success

Courses should be carried out in centers; **only** parts of the courses could be done in the field

Technical and extension services are required for project sustainability

Governments can provide various packages to support these projects (e.g. lease-taxation)

**Source:** Asian Development Bank, 2004, Special evaluation study on small-scale freshwater rural aquaculture development for poverty reduction.
Subsides & supply of production inputs

- Governments may feel responsible for providing some essential inputs especially when producers have extremely limited resources.
- Production inputs could be “all”: (e.g. Rwanda, Thailand and Colombia).
- Production inputs could be “only seed”: (e.g. Cameroon, Zimbabwe, and Guatemala) – In India, Indian carp seed has been distributed at 50% of its cost.

Why fish seed?

- Fingerling production may be out of the ability of target beneficiaries or may represent a substantial cost especially for subsistence farmers.
- Providing fish seed would eliminate doubts related to seed quality in regard to project performance.
Subsidies and credit facilities (Case studies)

**China**

- The government does not subsidize farm inputs except in very few cases
- The government offers a 200 yuan/mu subsidy to encourage shrimp farmers (1 yuan=0.16 US$; 1 mu=666 m²)
- Fish farmers obtain credit through the Agriculture Bank of China (ABC) and Agriculture Credit Cooperation (ACC)
- Credit policy targeted to support national agriculture development strategy and has been used to support specific crop production. (Economic tool)

**Panama**

- Cost sharing approach has been adopted - a part of the cost should be tolerated by beneficiaries
- Success is measured by farmers' acceptance to provide their share of the cost (not necessarily equal shares)
- Ministry of Agricultural generally provides bulldozers for earthmoving
- Project participants provide labor, housing, and food for the bulldozer operators, diesel fuel for the bulldozer, and all other materials needed to construct the ponds
Free supply of production inputs

**Negative opinions**

- According to FAO study, the number of free fingerlings delivered was frequently **lower than reported numbers**
- Dependence of producers on free supply of seed has been reported to be a major cause of the failure of aquaculture projects
- Free seed from governmental hatcheries may hinder the development of private seed industry especially for the provided species
- Unfortunately, it seemed easier for the extension agent to supply free seed rather than train farmers to produce their seeds
- The transfer of seed production technology should be attempted before the free supply of seed whenever applicable (Panama)

- Real farm economics may be difficult to assess in the light of subsidies
- Beneficiaries will get used to it. Efforts will be spent for its continuation rather than trying to produce their own seeds
- If a government terminates or suspends the free gifts for whatever reason
- Farmers feel that, if they wait long enough, the government will resume the subsidy
- If the termination of subsidies continues, the sustainability of projects could be threaten
- Farmers who are not getting such incentives may develop jealousy feelings
- Could lead to unnecessary corruption
Role of associations, cooperatives & other umbrellas

**Case study in Kerala India:** A model of homestead ornamental fish farms that are run by rural unemployed people in their homes.

Farms are linked to satellite farms that provide fish seedlings as well as the infrastructures.

The production from the homestead farms will be taken by the satellite farms.

This activity comes under the umbrella of a Kerala government initiative; Kerala Aqua ventures International Limited (Kavil).

The initiative targets to produce and export ornamental fish of particular species to meet the growing demands.

Small producers should get fair returns for their efforts.

Associations and cooperatives could endorse small-scale producers when buying production inputs.

Cooperatives could act on behalf of small producers who lack collaterals for accessing credits.
# External - funded priorities (national & international perspectives)

## Advantages

- External funds intend to bring international experiences into national programs
- National systems are responsible to highlight the country needs
- Working on and resolving areas of conflicts –if occur- was successful in most cases (but not all)

It turns sad when national systems modify priorities or insert some parts in order to fit the donor interests

## Concerns

- External fund is not always a blessing especially in work atmosphere
- When the external fund ends, it becomes difficult to operate and maintain facility that begins to deteriorate
- National extension priorities that are often placed on food security and quality of life may not agree with the interest of international donors
Poaching

- Although it is a sad incidence, it happens
- Incidences increase as fish ponds or cages are far from farmers' households
- Security arrangements may be needed (e.g. clustering operations, anti-theft or planting sticks)
- Guarding arrangements among producers is found effective

Credit of above photos: Kevin Fitzsimmons (USA)
Examples of small-scale aquaculture projects
The integration between rice and fish is an old practice in Madagascar that goes back to around 1900.

The practice began with several fish species which are namely common carp (Cyprinus carpio), goldfish (Carassius auratus), and black diamond cichlid (Paratilapia pollen).

Recently, tilapia is being integrated in the system.

The adaptability of fish species to the rice system as well as the demand on these fish has been the main criteria in selecting these species.

The involvement of private sector has been found essential in regard to overcoming the system obstacles such as the limitation of fish fry.

There are about a million hectares of rice fields in Madagascar.
Rural aquaculture in Malawi
Communal/rural fish ponds

Stocking of fish fingerlings in a communal fish pond located in Nangwangwa village, Nkhotakota District in central region of Malawi
In such communal system, members are helping each other in fish farming operations.
The stocked fish species are Oreochromis shiranus (Nkhututu) and Tilapia rendalli (Nungutchale).
The area in the pond shown is about 400 m²
Women are involved in this activity

Based on published survey report:
There are about 4,000 small-scale fish farmers in Malawi
A typical farmer has 1-2 small pond and harvests about 13 kg of fish/year
Ponds are normally constructed by family members and sometimes with hired labor
The majority of farmers use maize bran as feed and green compost for pond manuring.
Partial harvesting is the norm
The current outputs from fish farming –although modest- form an important part of household livelihoods and provide an additional option for increasing the overall value of the farming system
A small-scale aquaponic project has been designed and run for family consumption.

Regardless the small size of this project, almost all principal components of aquaponics do exist including, water and fish tanks (100-gallon each), plant grow-bed, water pump, air pump, lightening system, tubing, etc.

Blue gill (Lepomis macrochirus), was the chosen fish species especially the introduction of tilapia to specific counties of California –including Sacramento- is banned.

In order to ensure a better growth for the blue gills, arrangements are taken to maintain water temperature at 16 C and above. Fingerling feed with 50% protein is used in this particular operation.

Plants and herbs have been chosen based on family consumption pattern.
Typically, in aquaponic projects, fish waste fertilizers plant crops and hence there is no need for external fertilizers.

Leafy vegetables (e.g. lettuce), tomatoes and herbs are commonly used in such systems, and so do flowers.

In regard to the fish, several species are commonly used with tilapia been frequently recommended.

Because of the simplicity of the design, simplicity to construct, easiness to operate, and its relatively low cost, the models shown here have been designed for people with limited resources especially in situations without much horizontal space.

Outcome of small-scale aquaponics have been encouraging towards potential applications in rural communities especially in regard to improving the nutritional status to poor families in addition to providing some cash.
Seaweed farming and utilization in Solomon Islands

The red seaweed, *Eucheuma* sp. was introduced into Solomon Islands for the first time in 1988.

- With the aid of a national seaweed project, a noticeable expansion in seaweed farming took place in several provinces in Solomon Islands resulting in preparing about 20 tons of dried seaweed for export in 2003.
- Through the national seaweed project, farmers were trained as well as the seaweed seed was distributed to beneficiaries from given communities such as Rarumana community and Waghena community. In general, the seaweed farming is oriented to export as no local markets do exist for the product.
- The seaweed species farmed in Solomon Islands can be used for toothpaste, flavored-milk drink and pet food.
- The seaweed farming in Solomon Islands is considered a growing industry based on the increasing number of farming sites as well as the active seaweed farmers who were estimated to be 250-300 farmers in 2011. The socio-economic benefits generated by seaweed farming are considered the key outcome of this activity.
- The fluctuations in seaweed production in the past decade has been attributed to the low market prices, presence of fungal diseases and the tsunami of 2007 which destroyed key seaweed farms.

**Notes**

Farmers have been trained
Orienting the product for export was known since beginning
The seaweed species was chosen to meet the market demand
Some risks are always expected

Credit: Secretariat of the Pacific Community (SPC)
Small-scale projects and human health

There is a long historical record of nutritional merit and safe use of spirulina. Spirulina is rich in beta-carotene and hence can overcome eye problems caused by Vitamin A deficiency.

Very digestible and has very high 65% protein, B-vitamin complex, iron and trace minerals. Has a substantial GLA, an essential fatty acid that helps regulate the hormone system.

Spirulina culture in Burkina Faso

Some of small-scale spirulina operations of 8-m² pools have been built at some hospitals.

The product received the approval of Ministry of Health in 2005.

A spirulina provides the portion that goes rehabilitation and health centers is subsidized and sold at loss.

Spirulina culture in Farende village (Togo)

Dried paste of spirulina was distributed at the health clinic whereas undernourished children took it as a daily supplement.

One 100m² pond could supplement the diet of 100 children a day.

It has been claimed that undernourished children when taking a tablespoon a day mixed with water brought great results.
Mola (*Amblyparyngodon mola*) is a small indigenous fish that do exist in household ponds and natural waters in Bangladesh.

In addition to the animal protein content, mola is rich in vitamin A (20 times higher than commonly cultured fish species). Mola is also rich in calcium, iron, zinc, and phosphorus.

Including mola as part of the diet can help those suffering from malnutrition and micronutrient deficiencies, especially pregnant and lactating women and children younger than 2 years of age.

**Human nutritionists claimed that “mola” can play a major role in lowering the incidence of child blindness, night blindness and infant mortality in Bangladesh.**
Small-scale projects and human health
Culture of “Mola” in rice fields (Bangladesh)

Production features of “mola”:
Feeds on natural food organisms stimulated by fertilization
Spawns naturally two to three times a year (no need for sophisticated hatchery facilities)
When cooked as a whole and processed into a paste, and mixed with rice and vegetables, turns to a child-friendly one-pot meal (khichuri) which is high in micronutrients.

Notice that focus has been placed on health benefits rather than biomass produced or monetary revenue.

Photos’ credit: World Fish Center
Conclusion (1)

Integrating aquaculture in rural development programs through family farms could generate significant social benefits when carried out properly.

Simplicity concept of small-scale projects means simple operations but never simple planning.

Improper or easy planning was behind the failure and the non-adoption of these projects as been hoped.

Earlier studies have indicated that small-scale farmers can potentially benefit from the advances of research. GIFT tilapia performed well enough when disseminated.
Although the social dimension in rural aquaculture is of top importance, the economics of these projects determines its sustainability.

Social nature of these projects should not come into conflict with environmentally practices or quality standards.

Total and unlimited dependence on external assistance threatens the sustainability of these projects.

It should be remembered that subsidies and support should be of temporarily nature.

Although rural aquaculture, implies simple practices and modest outcomes, there should be some room for development even if beneficiaries move out of this category.