

Strengthening Sustainable Development of Aquaculture

in Southeast Asia: Interventions and Strategies to Enhance the Multiple Roles of Aquaculture in Rural Development

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The social context of aquaculture in most of Southeast Asian countries is rural poverty and therefore its purpose is to improve incomes and distribute wealth. This does not preclude support for large commercial and industrial-scale operations as there are mechanisms and models by which these types help in rural economic development. A review of selected aquaculture and community aquaculture-based fisheries projects and programs in several countries in the region show three recurring themes common to the progress of aquaculture, namely: policies and institutional changes in support of poverty-focused aquaculture, the driving force of markets, and technology development and adoption by small and poor farmers.

Policy and Institutional Change

Most countries in Southeast Asia have recognized aquaculture as a distinct and separate sector or industry and therefore a major part of the national strategy for reducing rural poverty. For example, the Vietnamese government's aquaculture development program 1999–2010 sets out the country's vision to prioritize aquaculture development for reducing hunger and poverty. In the Philippines the latest medium term development plan (MTDP) and the Fisheries Code of 1998 target modernization of aquaculture technology for the poor.

The institutional arrangements for aquaculture in Southeast Asia vary widely. There are many institutions involved in land and water lease, environmental control, sanitary measures, pro-poor programs, and trade. Responsibility and jurisdiction is split between federal/central and state/local authorities in different manners. Nevertheless, coordination between agencies is improving, for example, specific spatial regimes have been created for aquaculture in Cambodia (Poverty Reduction Strategy Plan) and Malaysia (food security in 5-year plan) that make reference to aquaculture in national policy or planning documents. Malaysia has set up aquaculture investment zones while the Philippines has been establishing mariculture parks, and Indonesia has developed aquaculture zones for nucleus-estate type export aquaculture.

Most countries in the region continue to allocate public resources for aquaculture by: i) establishing hatcheries and ensuring seed stock availability; ii) establishing

demonstration and training farms; iii) training of farmers; iv) selecting and providing full assistance to key farmers to apply and showcase a specific culture system; v) fielding extension workers; vi) providing special loan programs and in rare instances, marketing assistance; and vii) extending financial incentives for large-scale development.

Aquaculture can therefore be worked into policy and planning through its contribution to rural development generally and to income generation and food production. For example, Vietnam's Sustainable Aquaculture for Poverty Alleviation 2000 (SAPA) strategy recognizes the need for raising awareness on aquaculture opportunities, improving participatory approaches and institutional capacity (**Box 1**). It also recognizes the gap between the needs of farmers and the services offered by extension institutions and issues of access to markets and financial services by the rural poor.

Structural Changes in Southeast Asian Aquaculture

Technology has transformed the region's aquaculture from a subsistence food production system to a major agribusiness industry. Hatchery technology, pelleted feeds production and disease control have revolutionized the structure of farming systems, expanding and intensifying production. Modern fish farming technology has expanded beyond the traditional ponds, to rice fields, floodplains, rivers and coastal waters supplying vast quantities of food fish to growing domestic and international markets.

Box 1. Objectives of Vietnam's Sustainable Aquaculture for Poverty Alleviation 2000

- To enhance the capacities of poor people in rural areas to improve livelihoods through awareness raising and improved aquatic resources management and aquaculture;
- To strengthen the capabilities of institutions particularly local institutions, to understand and support the objectives of poor people in inland and coastal communities who benefit from aquaculture;
- To share environmentally sound, low-risk, low-cost aquaculture technologies and aquatic resources management practices; and
- To develop national policy based on lessons and experience from local pilots and inter-sectoral collaboration on strategies for addressing poverty.

On-farm fish production is only one link in the aquaculture value chain, accounting for perhaps much less than half of the total value addition of the industry. Progressive commercialization has led to a strong agribusiness-focus in the operation and management of rural aquaculture. It has prompted fish farmers to become selective in the choice of farmed species, adopt new and better fish cultivation technologies, and establish links with a whole chain of activities from production and marketing of fish seed and fish feed to icing or refrigeration, transport, storage, processing and retailing or export.

Many formerly subsistence, household- and family-based aquaculture systems like Vietnam's VAC (Garden-Livestock-Fish) system gradually evolved to more commercialized agribusiness aquaculture enterprises, such as the cage and pond culture of *Pangasius* spp. (basa and tra catfish) in the Mekong Delta. The new trends brought in more intensive production practices forcing changes in the industrial organization of aquaculture. As individual farms became linked to more organized input and output markets, consolidation occurred along the entire commodity supply chain. This consolidation in turn delivered economies of scale, greater efficiency and huge increase in basa and tra production as well as in the number of households involved.

Markets for high value fish as drivers of change

The rise of export trade has produced significant structural changes in the development of aquaculture in Southeast Asia. Rapid changes in the culture systems, species choices, and propagation and processing techniques have been taking place in response to increasing and changing consumer preferences and demands. As a result, not only the traditionally fish eating Asian countries (such as China, Bangladesh, Vietnam and Thailand) have increased and diversified aquaculture production but, in less than two decades, countries with relatively low level of fish consumption (for instance India, Iran and Pakistan) have also joined the ranks of aquaculture exporters. Thus, the trend of export trade for fish from the region which focused on three major markets, the US, Japan and EU, is expected to shift to increasing intra-regional and south-south trade. A response to market requirements is the growing coordination of private sector input and output chains. Formal and informal links between smallholder producers and large processing companies are leading the industry toward more efficient and competitive business environment: better quality assurance for consumers; secured margins for producers; and competitive prices for products. Export certification schemes have further streamlined production, processing, distribution and retail chains. The product chains for one species after another - shrimps, catfish, tilapia – follow this integrating structure.

In Vietnam and Thailand the aquaculture product chains are increasingly molded by urban consumption behavior, as supermarket chains force product quality control in both domestic and export markets.

However, the complexities of food safety and public health concerns and other technical barriers have had dramatic effects on market access for the Southeast Asian countries. The impacts have had a disproportionate effect on small-scale producers and smaller economies due to economies of scale in the cost structure of HACCP (Hazard Analysis and Critical Control Point) and SPS (Sanitary and Phytosanitary Standards) compliance regimes as well as to non-technical barriers of trade. Elimination of harmful tariffs such as tariff escalation and tariff peaks can result in huge gains for poor people involved in the input supply and value-added activities.

Species diversification

In Southeast Asia, 70 species are being cultured (at any one time in the world there are 150 and since records became available, there have been more than 400 species cultured). There has always been an appetite for new species for aquaculture. Tilapia and catfish have both made a huge inroad as cultured species in the last decade. Grouper and other reef fishes, sea bass, shrimps and prawns as well as eels are already established as favored fish in the Asian upscale market.

Seaweed is a highly consolidated industry although a few global corporations dominate the processing and distribution of non-food products. However, the farming and primary processing can be widely dispersed in rural and poorer communities. Recreational aquaculture such as the raising of ornamental fish and fish for angling has been promoted in peri-urban areas.

Impacts of Aquaculture on Poverty and Livelihood

In Southeast Asian countries, aquaculture systems have been developed to enhance the livelihood in rural communities (**Box 2**).

In most countries in the region, fish farmers generally earn higher household incomes than other farmers. In Vietnam for example, 50% of the farmers involved in aquaculture derive on the average 75% of their household income. In addition, 80–100% of aquaculture products from Vietnam's rural farm households are marketed confirming that aquaculture is primarily a cash-generating activity. Small-scale tilapia farmers in Central Luzon, Philippines showed average net annual earnings 48–49% higher compared to rice farming. In many countries in the region,

the average market price of fish is lower than those of other animal products, such as chicken, pork, and red meat. Low aquaculture commodity prices in the region for such products as carps and tilapias, make fish highly accessible to even the poorest segments of the population.

Moreover, many aquaculture activities such as shrimp seed collection and artisanal production of fish trapping and packing materials are important sources of employment for rural women. Projects that targeted women and poor households provide access to land, water, credit and extension which they could not afford otherwise. The same is true in fish processing factories in Vietnam, which employs primarily young females between 18 and 25 years old. Although salaries of these workers are still quite low at US \$1–3, they are higher than wages earned from

agricultural activities in their home villages. Aquaculture in Mekong Delta (catfish farming, rice-fish and rice-prawn farming) contributes to a decrease in migration by young women from rural areas to urban centers by offering local opportunities to earn a living. Most of the laborers in catfish farming households also enjoy better and more stable income, have fewer concerns about their daily food source, and are able to send small amounts of money to their families.

Small-holder Aquaculture

There are a number of examples from Southeast Asia of small-holder aquaculture systems that have improved incomes of resource-poor rural households. The aquaculture component of the popular integrated fruit trees/vegetables

Box 2. Examples of aquaculture systems and strategies to develop rural communities in Southeast Asia

Indonesia

Segmentation of the production processes: creating more employment and raising technical efficiency. Segmenting the production process attains for the sector higher technical efficiency, increases the opportunity for achieving better economic efficiency, and creates more jobs and values along the chain. The satellite seed production and distribution system pioneered by Indonesia is a good model, where the government hatchery maintains breeder stocks because the private sector usually finds this part of the chain unattractive for investment, distributes (sells) the breeders to private hatcheries, supplies fertilized eggs or nauplii to backyard hatchery operators for rearing until nursing size and sold to nursery operators to further grow to fingerling size, which are then sold to farmers. This has been adopted recently by the Philippines for its milkfish industry.

Integrated livestock-fish farming in rice-based system: environmentally friendly, waste conversion, energy saving, risk-spreading strategy, self reliance. Integrated livestock-fish farming provides a viable option to poor rice farmers in Indonesia, earning them a higher net income than an average government officer. Combining chicken raising with fish culture in earthen ponds on rice farms allow farmers to optimize the utilization of on-farm wastes, and supplement feed and fertilizer inputs to increase farm production and net household income. Although, a relatively low cost agri-business, majority of poor farmers find it difficult to adopt the technology or practice due to lack of credit, and burden of high initial cost of digging ponds on the farm.

Large-scale shrimp farming in “tambaks” transforms Indonesia’s coastal villages. Traditional coastal rice areas “tambaks” are being consolidated for shrimp production. Often the investors/leaseholders of “tambaks” are urban people attracted by profitability in shrimp farming. The operations and management of shrimp farms are usually done through locals, and financed by informal lending or investment. Large-scale operation of “tambaks” for shrimp farming has attracted other forms of investment in rural areas, such as electricity, roads and water, connecting remote rural hinterlands with urban commercial areas. The transformation has provided an avenue for people, formerly farmers but now caretakers, managers or workers to earn income. But financial institutions have not shown interest in providing capital to local people who want to invest in shrimp farming on lands they possess or hold under lease rights. Absence of land titles is a big hindrance in obtaining institutional financing.

Philippines

Tilapia farming as a small business. Freshwater tilapia (cage and nursery) farming generates employment opportunities for small-scale operators, caretakers, laborers, and their households, particularly in the rural areas where employment opportunities are limited and labor supply is abundant. Backyard/small-scale pond and cage farms rely mainly on family labor. Roughly 24,000 people in Pampanga and Nueva Ecija (Central Luzon), inclusive of tilapia workers and their household members, are likely to depend directly on tilapia pond farming for employment. Caretakers and salaried workers on small tilapia farms earn P2,000-3,000 per month. In addition, they sometimes receive free food and 10% of net profits. Some large-scale tilapia farmers hire caretakers at P3,000 per month and give them 15-20% of net profits. Thus, tilapia pond farming provides both employment and income benefits to poorer workers who would not be able to establish their own ponds. Fish consumption increased significantly in farming households, and the supply of tilapia from cage farming has helped keep tilapia prices stable, making it more affordable to lower income consumers.

Thailand

Finding ways to benefit fully from market chains. With increasing attention to food safety such as labeling and traceability, market chains are becoming more vertically integrated. According to the “farm to plate” philosophy, Thailand declared 2004 as “Food Safety Year” to increase awareness and improve systems for safe aquaculture production, and link “safe” food producers to processors and market access. Capacity building and technical assistance have ensured that small-scale producers can participate and benefit from such trends. The implications of trace-ability for the small-scale services and input suppliers surrounding some aquaculture systems with very fragmented input supply and trading systems remains to be seen. Vertically integrated market chains may provide producers with more stable markets, and perhaps opportunities for funding from “higher” in the chain (i.e. consumers pay a premium price) to support costs of transition to better practices. The experiences of Thailand generally reflect the struggles of the export oriented sector of Asia. Market access and trade issues have made public-private sector alliances compelling. The market, but particularly trade, is driving the sector to be more competitive and environmentally friendly. This has led to the development and implementation of a mix of regulatory and voluntary management mechanisms jointly developed by the government, industry and farmer groups. The voluntary mechanisms have resulted in increasingly widespread adoption of better management practices.

Box 2. Examples of aquaculture systems and strategies to develop rural communities in Southeast Asia (Cont'd)

Vietnam

Traditional practices such as rice-fish and rice-shrimp culture, and integrated fish, livestock and crop cultivation, including the widely known VAC system, have provided an entry point for Vietnam's rural people (majority of whom are still engaged in farming) to improve income and livelihoods within the limits of available land resources prior to moving toward intensive commercial aquaculture supported by more liberal land use policy and opening up of export markets. But even in some of the more advanced aquaculture practices such as basa (catfish) aquaculture, shrimp farming or intensive tilapia farming in freshwater ponds, there are significant income and employment opportunities for the poor people including those in upstream (seed production and supply provisions) and downstream (processing and marketing) activities.

Improving income and livelihoods in the early days of economic liberalization. The VAC, which is totally family-managed, can be found in irrigated lowlands, rain-fed uplands, and peri-urban areas of Vietnam. The system is a mix of annual and perennial crops including fruits and vegetables, cattle, pigs and poultry, with several species of Chinese and Indian carps grown in ponds. Annual yields of 2-3 tons/ha are commonly achieved while semi-intensive systems, especially with tilapia, may reach 4.5-5 tons/ha. Since 1989, the Vietnamese government has distributed land for farmers and encouraged the development of the family economy through diversified agriculture, not only by growing rice. In many Red River Delta communities, VAC farming constitutes 50-70% of farmers' income, with annual income three to five times higher than that from growing two rice crops per year. The system is labor intensive, but does not require hard manual labor, and affords productive employment for people of all ages. The system also helps protect the production environment, and improve family health and nutrition. Today in Vietnam, the VAC system is considered to be an effective solution for poverty alleviation, dietary improvement, and prevention of malnutrition.

Aquaculture in the Mekong Delta: Revolutionizing rural farms with employment and wage benefits. The Mekong Delta is now home for Vietnam's intensive aquaculture, accounting for 85% of national aquaculture production. Intensive catfish (*Pangasius* spp.) culture in the Mekong Delta started in cages in the 1960's and in ponds since 1999. The produce is mostly exported. Cage and pond culture of catfish provide employment for 11,058 households through own-farm employment. Considering that each household hires two laborers for fish feeding, about 30,000 poor landless people are estimated to be working in catfish farming. On average, each hired laborer working on fish cages and ponds gets about VND550,000-600,000 (US\$36-40) per month or less than US\$2 per day. In 2003, there were also 5,300 workers with a salary income of less than US\$2 per day in five catfish export processing factories in An Giang Province. The number of workers in fish processing in Dong Thap, Vinh Long and other parts of the Mekong Delta is about 3,000. Poor women make up a particularly high proportion of workers (>70%) in the processing factories. Several thousand people are also employed in related services sectors (finance and credit organizations, fish feed and seed producers and traders, veterinary services, storing and transportation, etc.). Basa catfish is mostly reared in cages on the Mekong River, and its production in ponds together with tra catfish has been growing. There are 83 fish and 32 giant freshwater prawn hatcheries in the Mekong Delta area, and five processing and export factories operate in An Giang, the main catfish-producing province. Indeed, all these provide significant rural employment.

– fish/shrimp pond – livestock pen system (VAC) in Viet Nam contributed 30-70% of the income from the total farming system. The success factors of Vietnam's systems are shown in **Box 3**. Fish is produced mainly for family consumption and the surplus for sale. Integrated small-scale aquaculture is becoming a more popular farming practice in the rural areas. Both inputs and outputs of this small-scale integrated system are increasing, indicating the growing interest of farmers to intensify production. This has resulted in better economic returns.

In Indonesia, the main small-scale aquaculture systems are freshwater pond culture, rice-fish culture and fish rearing

in small net cages in inland and coastal areas. About 78% of the households cultivate fishes in a freshwater farm of less than 0.05 ha. The aquaculture component increased net revenue from rice-fish culture and net cage culture increased overall household revenue. Aquaculture is the main income source of 6.6% of the freshwater pond and paddy-field culture households and 23.6% of the net cage culture households. In comparison, aquaculture is the main income source of the brackishwater pond culture households and 57% of the marine net pen culture households, with agriculture providing a secondary income. Intensive carp polyculture, which is also popular in Vietnam, provided a bigger share of household income than traditional fish operation using simpler methods.

Box 3. Success factors for selected pro-poor aquaculture technologies and systems (Vietnam)

Pangasius "Basa" catfish

- policy shifts - withdrawal of restrictions on land conversion
- technological advancement and their successful application - extension and training services along with credit support

VAC System

- opening up of market economy
- growing demand for fish in urban markets
- available labor and external inputs
- opportunity to integrate and diversify farming systems, with improved cash flow and net household income through modest and gradual investment

Strategies for Interventions

The above examples suggest a range of policy and technological support, interventions and strategies for small fish farmers. Specifically, a number of suggestions (**Box 4**) could be considered to enhance the multiple roles of aquaculture in rural development particularly in addressing poverty issues in the fisheries communities.

Box 4. Strategies to enhance the multiple roles of aquaculture in rural development

- a. Low-input technologies can be adopted, promoted and supported through facilitating credit, infrastructure development and creation of public and private institutional support mechanisms
- b. Wider adoption of integrated agriculture-aquaculture systems permits the sustainable expansion of aquaculture where it is most needed, improve the productivity and sustainability of farms and reduce impact on the environment (by recycling farm wastes)
- c. The adoption of small-scale environmentally friendly mollusc and seaweed culture by coastal artisanal fishermen, as an alternate rural livelihood, has the added benefit of reducing pressure on wild fish stocks and cleaning the coastal waters
- d. Common property water resources such as flood plains, swamps, reservoirs and irrigation structures could be developed or leased to poor households that otherwise lack productive assets while areas that are not suitable for agriculture, which are not critical habitats, could be used for aquaculture (e.g. saline soils)
- e. A farming systems research and extension approach could be established to identify the poor and assess their needs and resources, to adapt technologies to their local contexts, and to widely disseminate them to potential beneficiaries
- f. Pro-poor technologies are under-utilized, even in countries where aquaculture is a tradition, due to a number of constraints which should be addressed, such as absence of political will, limited institutional, human and financial capacity, institutional barriers, government restructuring, and reduction of government services for development
- g. Barriers to adoption of aquaculture or improved technologies by the poor that need to be cleared includes lack of security of tenure or a well-defined system of land and water use rights, difficulty in accessing inputs, credit and markets, and inappropriate technologies and lack of technical assistance
- h. Enabling policies and appropriate institutional arrangements to channel services to the poor should be instituted to address the various constraints (e.g. public linkages -- cooperation among several concerned ministries under one roof at provincial level and public-private partnerships -- combined government-NGO extension services; extension services through input providers, contract farming, etc.)
- i. Although favorable government policy and public sector investment are initially required, small-scale and even subsistence aquaculture could function largely as a private sector activity in order to sustain its contribution to rural livelihoods
- j. The less advantaged producers should be ensured of access to export markets, and fair share of benefits from the production chain
- k. Participatory processes for small-scale producers and organization of producers into groups and associations are important factors that could extend trade and market links



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