Quality management in the Pangasius export supply chain in Vietnam

Khoi, Le Nguyen Doan

5 Actors in the Value Chain of the Pangasius Industry[♣]

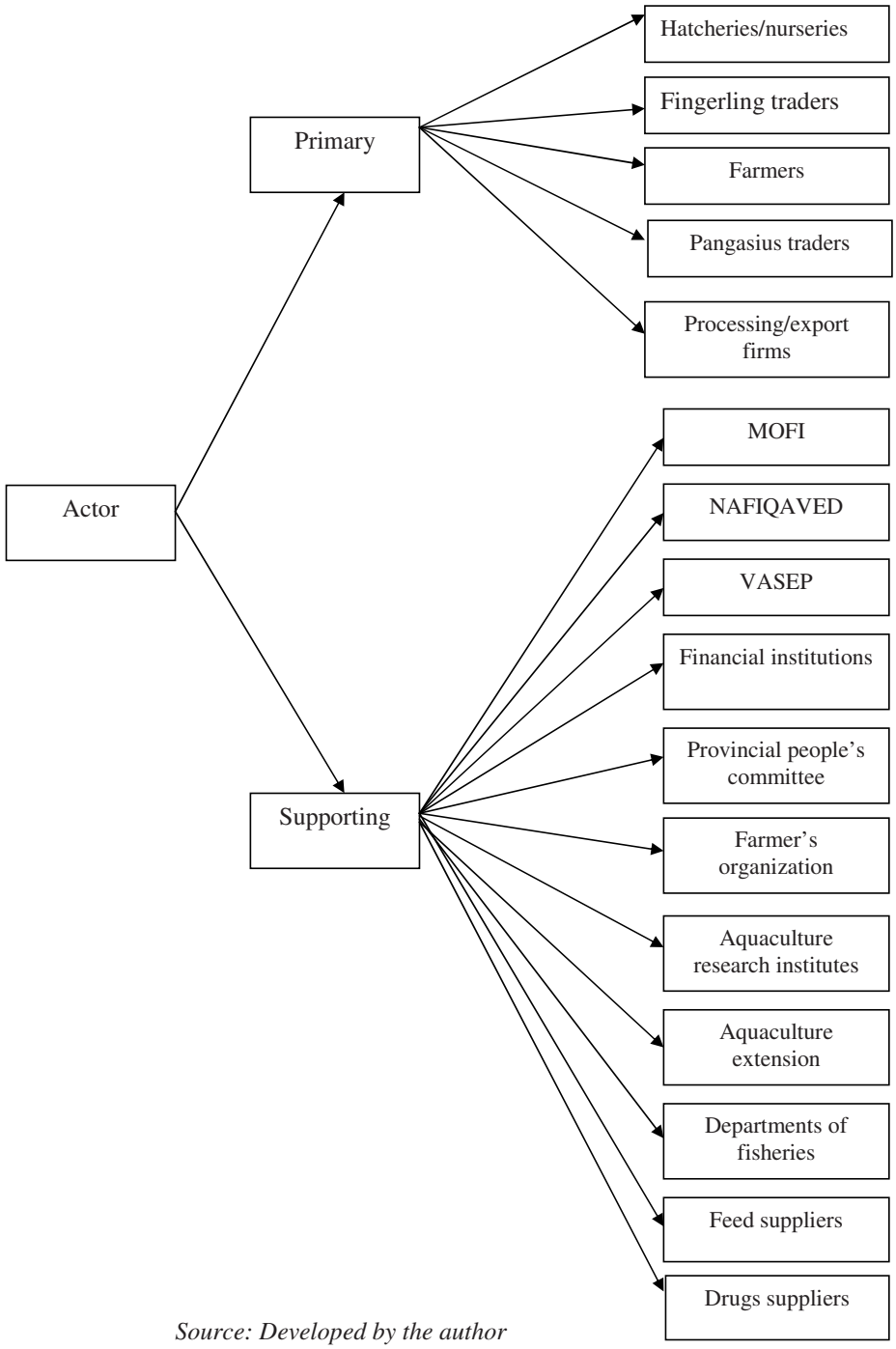
5.1 Introduction

The objective of this chapter is to describe the actors in the Pangasius value chain. A distinction is made between primary and supporting actors (figure 5.1). The classification of the actors is based on the activities that each chain actor performs. Primary actors are directly involved in the transformation of inputs into outputs, e.g., hatcheries/nurseries, fingerling traders, fish farmers, export traders, and processing/export firms. Supporting actors deliver services and training to the primary actors, e.g., MOFI, NAFIQAVED, VASEP, financial institutions, aquaculture extension services, feed suppliers, chemical/veterinary drug suppliers, departments of aquaculture, fishery associations, research institutes/Universities, etc. The description focuses on activities required for the export market.

The information about primary actors is based on direct interviews and field visits. In addition, knowledgeable people and experts in the fish industry were interviewed to collect information about the supporting actors. As these data were collected in the pilot phase of this study the main aim was to establish an overview of the value chain and the major problems regarding the inclusion of smallholders. At this step, a qualitative approach was followed on the basis of semi-structured interviews (section 4.3.1).

[♣] This chapter is based on Khoi (2007), *Description of the Pangasius value chain in Vietnam*, Center for ASEAN Studies, No. 56, Antwerpen, Belgium.

Figure 5.1 Channel actors in the value system of Pangasius industry



Source: Developed by the author

5.2 Primary actors in the Pangasius value chain

This section describes the role of primary actors in the Pangasius value chain. For each actor, the technical and managerial functions are discussed. Technical functions concern technical features of tools, equipment or methods that are necessary to produce goods with the required physical properties. Managerial functions are related to the decision-making process to activate the food production system, as well as the management system (Luning and Marcelis, 2007). We note that the two functions are related and, therefore, the distinction is not always straightforward.

5.2.1 Pangasius hatcheries/nurseries

The first process in the chain is the breeding of Pangasius. A hatchery produces fish fingerlings under controlled conditions. At present, there are hundreds of hatcheries and nursing farms in the MRD, mainly in the provinces of An Giang and Dong Thap (Department of Agricultural and Rural Development, 2005) which supply Pangasius fingerlings for almost the entire MRD area. To establish an overview of the activities three state-owned hatcheries and seven private hatcheries/nurseries were interviewed.

Private hatcheries and nursing farms produce on a small scale (less than 1 hectare) but are popular in An Giang, Can Tho and Dong Thap. They produce about 80% of fingerling supply in the MRD. These are often family businesses producing large amounts of fingerling in small ponds on simple nursing farms. To ensure the purity of the fish breed, the local governments have established state-owned hatchery centers (Khoi, 2007). For example, the Dong Thap Fish Experimental Station in Dong Thap province, the Cai Be Research Center for Aquaculture in Tien Giang province, and the An Giang aquaculture research and the hatchery production center in the An Giang province. State-owned hatcheries are larger than 5 ha and better equipped than private ones. The role of state-owned hatcheries is broader than the role of private producers; e.g., they conduct research on indigenous species, improve aquaculture techniques, and maintain quality brood-stock. The state-owned hatcheries supply just 20% of the fingerlings for the MRD (Khoi, 2007). As small-scale farmers usually buy their fingerlings from private hatcheries/nurseries, our research focuses on this group.

Technical functions

Before 1995, fingerlings were caught in nature. After each mating season, fingerlings swam along the Mekong River from Laos and Cambodia to the MRD, Vietnam. They were caught and sold to fish farmers.

Artificial propagation of Vietnamese Pangasius was successful in 1995 and contributed to a rapid development of farming these species. Now, there are hundreds of hatcheries in the MRD to produce Pangasius fingerlings.

At the moment, the public hatcheries (3 respondents) produce fingerlings following SQF standards, which record the original of brood-stock and produce certified fingerlings (Khoi, 2007). State-owned hatcheries select brood-stock from fingerlings produced in their own hatcheries for characteristics such as rapid growth and retention of the best performing individuals (interview, 3 state hatcheries, 2007). Records of these brood-stocks' participation in the production process are maintained (SQF standard). The interviews with nurseries (2 respondents) revealed that the state-owned hatcheries produced larvae of a higher and more consistent quality than those available from private hatcheries. Results showed that survival rates of larvae to fingerlings are around 30-35% as opposed to 20-25% for larvae purchased from private hatcheries. This incidence results from the state-owned hatcheries' use of only brood-stock with mature eggs.

The fingerling production process in private hatcheries is similar to the operations in the public hatcheries. The following general picture is derived from the interviews. All private hatcheries have ponds for nursing brood stock. Some (4 private hatcheries) seek to obtain brood stock from a variety of locations such as separate farms and separate locations in districts or provinces in order to maintain genetic diversity among their brood-stock. However, the brood-stock used for propagation in the private hatcheries often appear to be in poor condition and not suitable for producing quality fingerlings (Khoi, 2007).

To get good quality brood-stock, the pond should be prepared, cleaned out and limed before putting brood-stock are put into it (Khoi, 2007). The hatchery workers select good quality brood-stock for spawning (artificial propagation). The selection criteria for young brood-stock from a consolidated population include size, correct body shape, and color. If the females and males present sexual dimorphism in body weight (larger females, smaller males or vice versa) within the same population, attention should be paid to the sex ratio suitable for reproduction. Good Pangasius brood-stock should be at least six years of age, weigh 5-8 kg, and be full-bodied, with no visible signs of sores or haemorrhages.

Eggs of female and sperm of male fish are mixed and kept at a warm temperature until hatching. They are incubated for 18-24 hours in Zuger jars (an incubating machine) depending on the temperature, followed by 30 hours in a circulation rearing tank before becoming larvae and being stocked in ponds. Immediately after hatching the fish are referred to as larvae. A larva has a yolk

sac attached to it, which serves as a nutrient source. After a few days, the yolk sac is depleted and the fry swim to the surface of the water in the hatching tank, looking for food. At this point, the larvae now become fry. Fish fry prefer to eat small aquatic animals at an early stage, including small water fleas called moina and tubifex worms. The hatcheries can buy moina from farmers who cultured them or they can collect moina from ditches or canals in the surrounding areas by using a hand net. Tubifex can be found in water canals or bought from people who have specialized in this trade. Due to the fact that these actors are only part-time involved part-time in the production of worms, we did not include them as separate members in the chain.

During the first week, fry can be fed with home-made feed. From the second week onward, the feeds include cooked broken rice and fishmeal. These ingredients are mixed with other ingredients and are made by hand or by using a mincer to extrude noodle-like feeds. Until the ninth week, fish fry must grow to a size of 10-15 cm (15g). Then they are called fingerlings, before being stocked in grow-out ponds or sold to fish farmers.

Managerial functions

Most fish experts interviewed mentioned that some problems exist regarding to the quality control of Pangasius fingerlings. Many small-scale hatcheries/nurseries are active in the region, and the local authorities cannot control all of them (Khoi, 2007). According to Ms. Van, technician at the state-owned Binh Thanh hatchery, An Giang province, the quality of fingerlings is not guaranteed especially for private hatcheries and nurseries. Before the year 2003, the spawning season for Pangasus was only once a year from April to July (Cacot et al. 2002). After 2003, fingerling producers introduced spawning throughout the year to meet the increased demand in the chain.

For quality control, the private hatcheries use more chemicals and feed in an attempt to help the females to increase artificial fertilization and to reduce mortality rates. The overuse of brood-stock in the private hatcheries led to a higher use of veterinary drugs (Khoi, 2007). Another problem is the quality of feed and water. Poor feeding practices can lead to water pollution due to waste discharge from uneaten feed to the river. If the quality of public water is better, this affects the survival rate of fingerlings is affected and expenditures on fish health management increases. There is no residue control in the private hatchery and nursery phase and seed suppliers do not bear the responsibility for the final product nor for related issues in the grow-out phase (Bakker, 2007).

Considering the aforementioned production circumstances, we were not surprised to observe that it is not possible for private hatcheries to involve a third

party to certify quality standards (quality assurance). The quality is assured by the hatchery/nursery itself. Most private hatcheries/nurseries (7 respondents) give fish farmers a 10 to 20-day guarantee for the fingerlings and all mortality of the fingerlings is compensated by the private hatcheries/nurseries. The genetic quality, survival rate and other associate factors are difficult to quantify and guarantee. In this sector, reputation and conditions of sale are the key to quality assessment of the suppliers. Two factors make control of the quality of delivered fingerlings to the farmer difficult: first, there is a lack of adequate tests for the quality of fingerlings; second, fingerlings are sold to fingerling traders who combine batches of fingerling and supply to many small-scale fish farmers. These conditions explain why traceability is easily lost.

The state-owned hatcheries prefer to supply big farms, because larger volumes per transaction are ordered (expert interview, 2007). Moreover, the ordering process is quite rigid: farmers who purchase fingerlings from state-owned hatcheries must order 45-60 days in advance.

In conclusion, the state-owned hatcheries produce certified fingerlings with SQF standards guaranteeing the quality of fingerlings. They manage a brood-stock in relatively good conditions for optimal spawning success. Private hatcheries acquire brood-stock from different and sometimes inferior sources. Consequently, these hatcheries produce fingerlings with varying quality. However, the state-owned hatcheries produce only 20% of total market demand and prefer to supply bigger farms. Small-scale farmers must purchase fingerlings from private hatcheries/nurseries or fingerling traders. The upshot is that certified fingerlings are only available for large-scale farmers. The smallholders deal with fingerling traders, and quality is based on a long-term business relationship.

5.2.2 Fingerling trader

Most private hatcheries/nurseries (6 respondents) sell their fingerlings to local fingerling traders. Fingerling trading is a seasonal job, and in most places it begins in April and ends in September (Khoi, 2007). To arrive at an overview of fingerling traders, five fingerling traders were interviewed.

Technical functions

All fingerling traders (5 respondents) buy different fingerlings at different hatcheries/nurseries, and they sort the fingerlings on the basis of desired size. Fingerlings are simply size-graded using a hole in a receptacle. The size of fingerlings depends on the order placed by the fish farmers. Fish that can pass through the hole are sold, and farmers usually order fish sized 1.5-2.0 cm (Khoi,

2007). The fingerlings are stored in plastic bags filled with oxygen and water when transported to the farm gates. Transport takes place in the early morning or late afternoon when the temperature is cool. The plastic bags are placed in pond water for 15 minutes to reduce the temperature differences gradually; the bags are opened and the fingerlings are released into the grow-out pond (Khoi, 2007).

Managerial functions

All fingerling traders (5 respondents) have a long-term relationship with both hatcheries/nurseries and the smallholders. They are willing to sell small quantities to farmers and to deliver at the farm gate. Fingerling traders receive a 5 percent discount and trade credit without interest for a period of five to ten days (Khoi, 2007). All traders (5 respondents) give 1 percent extra fingerlings to farmers to substitute for potential losses (e.g., with 10,000 fingerlings the farmers receive 100 extra fingerlings).

In short, fingerling traders play an important role in the distribution of fingerlings to small-scale farmers. However, the organization of their operations makes tracing the suppliers impossible, and, therefore, certification of fingerlings or quality assurance is unfeasible.

5.2.3 Pangasius small-scale farmers

The third process in the value chain is Pangasius farming. This process involves the maturation of fingerlings until they are ready for the next step. According to MARD in 2004, in the MRD there are more than 15,000 households raising Pangasius. To establish an overview of fish farmers' activities, we have interviewed 20 fish farmers, who were classified into three types: pond (10), cage (5), and net-fence enclosure (5) farming.

Technical functions

Pangasius culture in cages was introduced and developed very early in the Mekong Delta (Phuong, 1998). The cage farmers (5 respondents) revealed that cage farming gives whiter meat than pond culture because of the cleaner water. For this reason, cage farming was preferred in the beginning. However, cage farming is more expensive, has higher fish mortality, and has a longer production cycle than pond culture. In addition, water quality is difficult to control in cage farming. After the price decrease in 2001, cage farmers experinced difficulty in making a profit using cage farming (figure 2.4). For the pond system, less technology is needed. Most farmers (90%) stated that pond culture receives the best results in term of productivity and environmental impact. To culture in enclosures, nets or fences are used to isolate a section of

the river, starting from the riverbank. However, like cage farming, managign the water supply in fences is difficult, resulting in more environmental pollution and disease outbreaks, as compared to pond farming (Khoi, 2007). At this moment, pond culture has become predominant in Pangasius industry and, therefore, this section focuses on pond farming.

All of the pond farmers interviewed (10 respondents) follow the same production technology. Pangasius production begins with the preparation of the pond. After draining, the chemical treatment (derris root and quick lime) is used to clean the soil in the pond. After three days of drying, the pond is refilled. Early in the morning or late in the evening, when it is cool, the fingerlings are transported in plastic bags to the pond. Most farms (90%) usually buy the fingerlings from the fingerling traders in districts, mostly in the An Giang and Dong Thap provinces. The fish farmers buy healthy fingerlings of 10-15 cm in size. Selection is done visually based on color (dark green on the dorsal side, silver on the ventral side, and clear stripes on the lateral side), and body deformation or injuries or damaged fins. Currently, some fish farmers (7 respondents) stock fingerlings in ponds when they know that the price of fingerlings will increase in the next season. The pond can be stocked with up to 30 fish/m^2. Twice a day, farmers feed fingerlings at a fixed time. Most interviewed fish farmers (90%) use home-made feeds that include trash fish, rice bran/broken rice, and soybeans. Industrial feeds are more expensive but are used depending on fish age, and contain different protein content ranging from 20-30% . It is generally agreed that home-made feed has a lower growth rate of fish but is the cheapest solution. Industrial feed is more expensive, but it results in better quality of meat and causes less pollution (Khoi, 2007) (see more details in chapter 8).

Managerial functions

Most farmers (8 respondents) have years of experience; others have only just started. Most farmers and workers do not have formal training in the aquacultural field (Khoi, 2007). Some of the bigger farms (2 respondents) hire competent technical managers, but most have learnt through experience. We observed that in particular small-scale farmers (6 respondents) lack basic knowledge on planning, monitoring, purchasing and applying inputs.

The water in the ponds comes directly from a river. However, the quality of the incoming water is not treated before it is used for farming (100% of farmers interviewed). Some farmers (4 respondents) have basic equipment for checking water quality. In practice, quality of water is controlled by looking at its color and the number of fish that die. If the water is too green, it is refreshed using a gasoline-driven pump.

The waste water of most ponds is discharged directly into the river (9 farmers). Another risk is that ponds can become contaminated by rain water from the paddy plots where chemicals (e.g., fertilizers or pesticides) have been used. These sites are usually not monitored (Khoi, 2007). Even though the carrying and self-cleaning capacity of the river is high, discharging effluents into the river contributes to water contamination (Bakker, 2007). Most farmers (8 respondents) stated that fish diseases are caused by polluted water. If any disease occurs during the production process a veterinarian should be consulted for specific advice and proper medicine (expert interview, 2007). However, few are veterinarians reside in Vietnam, and they are relatively costly. So a judgment is made on the basis of visual inspection of the fish (8 respondents), sometimes combined with the advice of the medicine salesmen (6 respondents). Generally, farmers use a cocktail of antibiotics is used to cure the fish (Dung et al., 2008) and some farmers use antibiotics as a preventative measure or to stimulate the growth. It is not uncommon for farmers to use old and sometimes forbidden antibiotics, which causes problems further down the chain. It is noted that 46% of the farmers use Dipterex, a forbidden antibiotic (Nguyen, 2007); however, it is not very harmful, as the concentration in the meat decreases very rapidly.

In conclusion, pond farming is the dominant production system in the Pangasius industry. Smallholders' knowledge is based on experience; however, they lack formal training and access to high quality inputs, such as fingerlings, feeds, and veterinary drugs. The stories of the interviewed farmers made clear that they have little knowledge of diseases and the veterinary drugs they use. We conclude that the distribution and proper use of drugs remains a major challenge for smallholders aiming at participation in global value chains.

5.2.4 Pangasius trading

Currently, Pangasius trading between small-scale farmers and processing firms is conducted by transporters. These transporters (2 respondents) are affiliated with processing firms.

Technical functions
The transporters use a special boat called a "ghe duc"[11] with a huge capacity and facilities to keep the fish alive. The average capacity of the boat is 20 to 40 tonnes of Pangasius. Shippers try to transport the fish to the processing companies on the same day, because the longer the transport takes, the more weight the fish will lose. The transporters cooperate with a technician from the buying division to check the quality of fish and the presence of malachite green, chloramphenicol, and nitrofuran (see appendix 6.3 for more details).

[11] "Ghe duc" means a boat in which water can flow in and out.

Managerial functions

The transporters do not process the product they buy. They fulfil the intermediary function and classify the Pangasius in terms of color, size, and weight. Poor quality fish or dead fish are sold to domestic markets through retailers. The traders must guarantee the quantity of fish until the Pangasius is weighted at the processing factories. They take responsibility for the mortality during transport. Therefore, they always try to transport fish on the same day, because the longer the transport takes, the more weight the fish will lose (Khoi, 2007). The transporters get paid per transport and the processors give them a 5-percent discount to cover mortality of fish (2 respondents).

5.2.5 Processing/export firms

The final process in the value chain involves the preparation of fillets by the processing factory for export. The average capacity of a firm is roughly 40-50 tonnes of fresh fish per day (VASEP, 2005). To establish an overview of processing/export companies' activities, we interviewed five processing/export companies that include private, state-owned and joint stock companies (see chapter 7 for more details).

Technical functions

All raw materials are inspected upon arrival and must be approved by the quality inspection team before being allowed into processing areas. After purchasing live Pangasius, the fish are washed, headed and gutted, filleted, skinned, trimmed, sized and classified, inspected on quality, frozen, and packaged for export or the local market. Fish waste from fillet production such as the head, tail, skin and viscera is processed into fish meal or fish oil. On average, fillets account for 30-40 percent of the weight of a whole fish. More specifically, 3.2 kilograms of live Pangasius are required to produce 1 kilogram of fillets. Frozen fish is the most common product, followed by dried products and fish sauce or paste. Moreover, high-value added products like filleting, ready-made, or surimi are also produced by various processors (Khoi, 2007).

To fulfil EU regulation, NAFIQAVED enforces EU standards for the processors. These companies (4 respondents) bought the latest equipment from developed countries such as Japan, America, and Germany in order to meet the higher demands of the customers. About 50 to 70 percent of their total investment has been made in processing technology. In the case of AGIFISH, for example, the company purchased individual quick-freezing freezers, air tunnel freezers and contact freezers. In addition, this company has also invested in the installation of scale ice machines, fillet graders and metal detectors to guarantee product quality.

Managerial functions

Fish processing plants are located in the MRD near fish villages. The five processing/export companies buy raw fish materials directly from the farmers through transporters. Since processing companies require larger volumes of fish, they prefer larger farmers to secure quantity and quality standards of HACCP and EU code requirements. Additionally, processing companies tend to culture their own fish for their processing activities (see section 7.3). This procedure helps processors become less dependent on external suppliers.

The processing/export companies (5 respondents) exported 90-95% of their products to foreign markets, and only 5-10% is delivered to local markets by agencies, supermarkets and food shops (see section 7.3). Moreover, all processing companies have applied the quality management systems of HACCP, ISO 9001:2000, and 2 respondents applied SQF 2000^{CM}. Therefore, all of them receive the EU code that facilitates export to the EU.

Most processing companies (3 respondents) in the MRD have at least 1,000 employees, 70-75 percent of whom are female. The employees in the processing companies are encouraged to attend training on quality management and specific work skills that serve the production and business activities of the company (3 respondents). However, only a small percentage of them were trained on how to use quality management tools, because the companies only focus on the process managers (Khoi, 2007).

5.3 Supporting institutions in the Pangasius value chain

This section describes the role of supporting institutions related to the primary actors in the Pangasius supply chain.

5.3.1 Ministry of Fisheries (MOFI)

MOFI is a governmental organization that consists of nine departments and four research institutes, namely the Fisheries Department, the Fisheries Resources Conservation Department, the Department of Planning and Investment, the Department of Personnel and Labour, the Department of Science and Technology, the Legislation Department, the Department of Finance and Accounting, the International Cooperation Department, the Ministry's Administrative Office, the Department of Inspection, the Research Institutes for Aquaculture (RIA) numbers 1,2, and 3, and the Research Institute for Marine Products. Recently, three National Brood-stock Centers (NBCs) have been established under these RIAs. The RIAs and NBCs are responsible for development of new varieties/strains or innovations in freshwater fish seed production.

The Fisheries Resources Conservation Department consists of a network of 37 sub-departments on the local level and is responsible for policy promulgation, direct management and the inspection of fisheries resources protection and development tasks. The Central Fisheries Extension Centre with its Representative Office in Ho Chi Minh city, along with a network of fisheries and agricultural extension units nationwide, are responsible for transferring experiences, techniques, technologies, and information to fishermen and farmers (in both public and private sectors). In 2004, the MOFI was continuing its administrative reforms with special priority given to the implementation of the Law on Fishery, which was approved by the National Assembly in 2004.

5.3.2 The Vietnam Association of Seafood Exporters and Producers (VASEP)

VASEP is a nongovernmental organization, founded in 1998, and based on the principles of voluntarism, autonomy and equality. VASEP's members include leading Vietnamese seafood producers and exporters and companies that serve the seafood sector. In 2003, VASEP had 185 members including 148 official members and 37 associate members.

The main roles of VASEP are to promote the growth of Vietnam's seafood industry and to facilitate the smooth export of Vietnamese seafood products internationally. VASEP is a bridge that connects Vietnamese seafood producers to customers all over the world. It provides Vietnam's seafood industry with market information, watches trends and develops national strategies for the seafood industry. It also organizes and implements trade-promotion activities and on-the-job and short-term trainings and supports the business expansion of member enterprises. VASEP supports its members in seeking financial and technical assistance from various sources to upgrade quality standards and add value to their seafood products. This support enables members to make their products more competitive in the world market. VASEP also represents and protects its members' legitimate rights and interests with regard to governmental authorities and third-party bodies (MOFI, 2003).

5.3.3 Export and Quality Control Organization (NAFIQAVED)

The National Fisheries Inspection and Quality Assurance Centre (NAFIQACEN) consists of a head office and six branches located in key fishery locations in the country. It is the national competent authority for fishery food safety assurance and quality control. In 2003, the Minister of Fisheries expanded the scope of the center's work to include veterinary matters (fish and shrimp disease control) and renamed the centre as National Fisheries Quality Assurance

and Veterinary Directorate (NAFIQAVED). NAFIQAVED only checks random samples, which explain why some contaminated batches are missed. Furthermore, proper testing tools are not always available (see more details in section 6.3.3).

5.3.4 Several financial institutions

Several banks offer financial services: the Vietnam Bank for Agriculture and Rural Development (VBARD), the Development Assistance Fund (DAF), the Bank for Investment and Development of Vietnam (BIDV), the Marine Bank, the Vietnam Bank for the Poor (VBP) (currently known as the Vietnam Bank for Social Policy (VBSP)). In addition, provincial authorities and government bodies invest directly in state-owned fisheries and fish processing enterprises. Moreover, some donors (UNDP, DANIDA) and NGOs that sponsor projects and provide credit to fish farmers in certain provinces of Vietnam.

The banks play an important role in providing loans on the basis of collateral (properties or agricultural land). However, access to bank loans is not sufficient enough to cover the farmers' needs. Informal sources of credit such as moneylenders, fish wholesalers, processors, and suppliers of inputs are utilized to finance working capital and investments.

5.3.5 The Provincial People's Committee (PPC)

Various departments of the PPC promote economic development in the provinces. Most policies and regulations are carried out through the guidance of the PPC. Each province has its own strategic development plan, which requires approval of the PPC. The PPC provides guidelines for fish farming, designation of areas, estimation of productivity as well as the capacity of the processing factories. The PPC includes representatives of the fish farmers and may intervene in negotiations between fish farmers and processing factories.

5.3.6 Vietnam Fishery Association

The Vietnam Fishery Association was established in 2000. The association has a nationwide network at the provincial level. They have their own funds, magazine, and extension activities. At the provincial level, most of members are fish farmers, processors, and aquaculture input suppliers. The establishment of this association was approved by the provincial government. After the collapse of agricultural cooperatives at the end of the 1980s and the beginning of the 1990s, the spontaneous and rapid development of seafood caused a number of problems as a result of a lack of planning. A good example is the An Giang

Fishery Association (AFA) that was set up in 2003 (see section 2.1.4). This association is a voluntary organization for farming and processing in the Mekong Delta. The organization's main objective is to protect fish farmers from risks in their cultivation and sales activities. Furthermore, the AFA provides market information such as prices of raw material on the national and international markets to its members. Information is disseminated through AFA's bi-weekly newsletter and through its Website. AFA also organizes training for farmers and other members. However, a widespread belief exists among its members that to be more effective, the AFA must take a stronger lead in the contract negotiations of small-scale farmers with processors.

Another example is the Can Tho Aquaculture and Fishery Association (CAFA) which was established in 2005. CAFA is an association for farmers, processors, feed companies, drug companies, and others who have some association to the Pangasius chain. At this moment (2008), CAFA has 160 members. The role of the CAFA is to organize meetings for the members provide them with market information from the sector, and facilitate the cooperation between the different members in the chain. For example, when the farmers and processors have a problem about price, the CAFA will intermediate between the parties to solve this problem.

5.3.7 Aquaculture research institutes and universities

The education and training system of the technical manpower for the fisheries sector consists of six universities, five research institutes, and three vocational schools.

(a) The six related universities include the Fisheries University in Nha Trang; Ha Noi University of Agriculture; the National University in Ha Noi; the University of Agriculture and Forestry in Ho Chi Minh City; Can Tho University, and the Fisheries University established in Kien Giang in 2003.

(b) The five research institutes are the Research Institute for Aquaculture No.1 in Bac Ninh, the Research Institute for Aquaculture No. 2 in Ho Chi Minh City; the Research Institute for Aquaculture No.3 in Nha Trang city, the Research Institute for Marine Products in Hai Phong City; and the Institute of Oceanography in Nha Trang City.

(c) The three vocational schools are in Hai Phong, Bac Ninh and Ho Chi Minh City. The National Aquaculture Extension Center was established in 2004. Its objectives are to organize, introduce, transfer the technology; to improve the technical and managerial knowledge and skills; and to cooperate with the other institutions to provide information on market prices for farmers to help them

improve the economic efficiency of their aquaculture farming activities.

5.3.8 Aquaculture extension and technology transfer

Aquaculture extension plays an important role in expanding documents and regulations of the Vietnamese government and industry as well as training and transferring technology to the farmers. The Aquaculture Extension Center was established in 2000, later renamed the National Aquaculture Extension Center in 2003. Six extension programs were implemented for aquaculture production with training courses for (1) reproducing seed of aquatic products, (2) shrimp culture (Penaeus monodon), (3) freshwater aquaculture (Pangasius), (4) brackish-water and marine-water aquaculture, (5) off-shore fishing and protection of aquatic resource, and (6) preservation, processing and improvement of product quality for export.

5.3.9 Departments of fisheries

Departments of fisheries (DOF) were established in the provinces where natural fisheries and aquaculture have an important role in the provincial economy. An extension centre is established under this department; otherwise activities are managed through the Department of Agriculture and Rural Development. All extension activities are combined under the management of the division of agriculture/forestry and fisheries at district and commune levels. At present, extension staff is a potential force for the development of market information system to the commune and farmers that aims to help the farmers take advantage of opportunities to choose input suppliers and output sales.

5.3.10 Feed suppliers

By the end of 2003, 15 public and 30 private companies were trading feed for aquaculture in Vietnam, with a total capacity of 100,000 tonnes of feed for pangasius fish production per year (MOFI, 2004). However, to meet the feed demand of aquaculture farmers, approximately 400,000 tonnes of feed were imported from Thailand, Hong Kong, Taiwan, and the United States (Sinh, 2007).
To ensure the compliance of environmental principles, a restriction on the use of antibiotics in feed was implemented. Some feed mills produced organic feed for fish farmers who wanted a high quality of fish.

5.3.11 Chemical/veterinary drugs suppliers

In 2002, the MOFI issued lists of chemicals and drugs that were permitted, limited, and prohibited for use in aquaculture. In 2003, NAFIQAVED reported

that there were 1,361 registrations for the production and 199 registrations for import of chemicals/veterinary drugs for aquaculture. In February 2005, the prohibited list consisted of 17 antibiotics, and 34 were listed as acceptable for only limited use. In August 2005, 11 compounds in the Fluoroqinolones group that were on the limited list became prohibited in US. and Canadian markets (Decision 26 in 2005 by the Ministry of Fisheries). Unofficial data and information show that roughly 800 types of chemicals/drugs are now used in aquaculture; however, only about 530 types were tested and registered before trade (Sinh and Nga, 2004). In addition, some of the tested, checked, and reported products were changed in name and function when traded (Sinh, 2007). We conclude that, to date, the supply of chemicals/veterinary drugs for aquaculture shows major weaknesses.

5.4 Conclusions

This chapter described the actors in the Pangasius industry. We conclude that the smallholders in the chain have only weak ties with suppliers and customers. Most transactions resemble spot-market conditions. Obviously, past experience with suppliers and customers is taken into account; however, formal contracts are exceptional. The advantage of this structure is flexibility. The disadvantage is a lack of coordination with serious consequences for quality. Processing firms targeting high-quality export markets prefer the supply of their own production units or the supply of certified large-scale farmers. The inclusion of smallholders in export value chains faces major challenges regarding knowledge dissemination and access to resources (fingerlings, feeds, drugs, finance). The following chapters deal with different aspects of these challenges.