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Description of the Pangasius value chain in Vietnam

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List of abbreviations

AFA	Fishery association in An Giang
CTU	Can Tho University
DARD	Department of Agriculture and Rural Development
EU	European Union
GSO	General Statistical Office of Vietnam
HACCP	Hazard Analysis and Critical Control Points
MOAF	Ministry of Agriculture and Forestry
MOFI	Ministry of Fisheries
MRD	Mekong River Delta, Vietnam
NAFIQAVED	National Fisheries Quality Assurance and Veterinary Directorate
PPC	Provincial People Committee
US	United States
VASEP	Vietnam Association of Seafood Exporters and Producers
VBARD Vietnam	Bank for Agriculture and Rural Development
VINAFA	Vietnam Fishery Association
VINAFISH	Vietnam Fishery Society
VCCI	Vietnam Chamber of Commerce and Industry
VND	VN dong (local currency)

1. Introduction

Aquatic products are among the dominant export products in Vietnam. The development of the fishery sector in Vietnam is a major source of foreign currency and employment opportunity. The success of the sector encourages both local and foreign investment. The total aquatic production of Vietnam increased from 1.11 million tonne in 1994 to 3.07 million tonne in 2004 (VASEP, 2005). The growth of aquaculture production was faster than that of catching during the past decade (from 0.33 million tonne in 1994 to 1.15 million tonne in 2004 for aquaculture compared with that of capture from 0.78 to 1.92 million tonne. Good physical conditions and traditional fish-eating habits bring about a high potential for aquaculture development in Vietnam, especially in the Mekong River Delta (MRD) which is considered to be the main aquatic area in Vietnam. This delta often contributes about 55-60% of the total aquatic production and more than 60% of the total aquatic production for export of the entire country (MOFI, 1995-2005). Tra (*Pangasius hypophthalmus*) and Basa (*Pangasius bocourti*are) commonly known as freshwater Pangasius. Since 1995, successful artificial propagation as well as expansion and improvement of the marketing of Pangasius products have led to a rapid development of farming activities of these species. In 2005, Pangasius products emerged as a leading source of export revenue (MOFI, 2005). Total production of Pangasius increased about seven times, from 45,000 tonne in 1997 to 315,000 tonne in 2004 (MOFI, 1995–2005). The MRD is the main source of the Pangasius production of Vietnam (300,000 tonne in 2004) (VASEP, 2005). According to the MOFI, the EU has become the biggest Pangasius market for Vietnam in 2006. Around 60% of the Vietnamese export to the EU is fish – mostly Pangasius from the MRD (MOFI, 2006).

In 2005, about 27 processing factories are located in the region, which can process 1,100 tonne of Pangasius per day for export. Pangasius is white fish, sweet, have a good smell, and do not have tiny bones. It can replace other species of white fish that are being exhausted. Pangasius is chosen as the symbol for Vietnam's aquatic due to its high quality. Pangasius of Vietnam is as famous as other well-known aqua products such as Norway's salmon (MOFI, 2005). Many problems, however, have been brought about by a rapid and inappropriate planned development of farming Pangasius in this delta, fluctuation price since 2003. In 2003, America accused Vietnamese enterprises of dumping catfish. Meanwhile Europe erected many technological barriers for the import of Vietnamese Pangasius (VASEP 2003). In seeking a sustainable growth for farming Pangasius in the MRD, the report will decribe the operations of actors in the Pangasius supply chain to find out the problems that are affecting the development of Pangasius aquaculture industry in the MRD.

2. Objectives of the report

- To describe and analyze the organization of the Pangasius value chain in the Mekong River Delta, Vietnam.
- To estimate the cost and benefits of various actors in the chain.
- To identify the main obstacles for the stakeholders in the chain.

3. Methodology

In-depth interviews and field visits were used to address the terms of reference. Interviews were conducted using open questions with knowledgeable people and experts in the fish industry. After that, all the actors who were directly or indirectly concerned with the fish industry were interviewed. The author interviewed the actors in the Pangasius supply chain including the people at hatcheries, fingerling traders, fish farmers, middle traders, retailers, processing/export companies and fisheries co-operatives, fishery associations, researchers, institutions in Can Tho City, the province of An Giang, the province of Dong Thap where the most cultured Pangasius from the MRD comes from. Besides, many documents that are related to the operations of fish culture from primary production and processing to distribution are referenced.

Sample design: the selection of the persons to be interviewed is based on the non-probability procedure, because the objective of the sampling is not to meet a cross section of the population. The main objective is to meet certain persons with information that is useful for the study. Therefore, through convenience sampling, members that are likely to give useful information for the study will be chosen as the sample elements.

Table 1: Name of fish related to the research

Scientific Name	**English name**	**Vietnamese name**
Pangasius bocourti	Basa Pangasius	Ca Ba sa
Pangasius hypophthalmus	Tra Pangasius	Ca Tra

The questions for the interview followed the value chain framework of Michael Porter (1985). According to Porter, value activities are divided into two broad types, primary activities and support activities. This model does not give us a full explaination of how the linkages in the value system are developed. So, it is important to link it with theories of inter-organization in order to develop business relationships among chain actors. However in this report, I will make a definition for fish trade activities following the Porter model.

Primary activities are the activities that include the creating of a product, marketing, delivering the product to buyers, as well as after-sales assistance/service. Primary activities are classified into five categories which include inbound logistics (activities associated with receiving, storing, and disseminating inputs to the product such as selecting and developing broodstock, receiving and storing fish raw materials, material handling, warehousing, inventory control, vehicle scheduling and returns to suppliers); operations (activities associated with transforming inputs into the final product form such as spawning broodstock, nursing fry to fingerling, fish culture, processing, packaging, inspecting, and facility operations); outbound logistics (activities associated with distributing fish to buyers such as delivery vehicle operation, order processing, scheduling and shipping); marketing and sales (activities associated with providing a means by which buyers can purchase the fish products and inducing them to buy through advertising, pricing, price information, promotion, channel selection, channel relation, and pricing); and service (activities associated with providing services to enhance or

obtain the value of the fish product after it is sold and delivered, such as training fish farmers, consulting, installing, repairing supplying parts and adjusting products).

Support activities underpin the primary activities and each other by exchanging inputs. Support activities are classified into four categories, namely procurement, technology development, human resource management, and firm infrastructure. Procurement (activities associated with purchasing inputs used in the firms value chain, not to the purchased inputs themselves: purchasing inputs include ponds/cages, fishing nets, incubating machines, circulation tanks, water pumps, grinding machines, boats, land, ice, fuel, machinery, labouratory equipment, office equipment and buildings). Technology development (activities that can be roughly divided into efforts to improve fish culture and processing facilities such as fishing methods, qualification rules or technology embodied in process equipment). Human resource management (activities associated with recruiting, hiring, training, developing, and compensating and (if necessary) laying off personnel). Firm infrastructure (activities associated with general management, planning to get access to fish, financial activities carried out, drawing up contracts, and fish quality management).

Slack et al. (2001) suggest that the identification of stakeholders can result in a useful classification of the performance objectives which any operation might pursue. Slack defines five performance objectives that can apply to all types of operations. These are quality drivers, speed drivers, dependability drivers, flexibility drivers and cost drivers.

According to Slack, quality drivers mean doing things right, satisfying customers by providing errorless goods and services which fit their purpose. Speed drivers mean doing things fast, minimizing the time between a customer asking for certain goods or services and the moment the customer actually receives them. Dependability drivers refer to doing things on time, making deliveries as promised. Flexibility drivers mean you can change what you do and are able to vary or adapt the operations activities to cope with unexpected circumstances or to give customers an individual treatment. Cost drivers refer to doing things cheaply, producing goods and services at a cost that enables them to be priced appropriately for the market while still allowing the organization to make a profit.

To be successful, the fish export companies must try to safisfy its customers. Exports to the EU are subject to many strict requirements in quality and safety of the fish. Therefore, the fish trade operations mainly refer to quality drivers and cost drivers. These two performance objectives will be applied in the analysis. We will now look more closely at each of these performance objectives.

Quality drivers consistently conform to customers' expectations. The concept of quality drivers is a broad one, that can be subdivided into the following categories:

-Functionality: the characteristics or features of a product or service that determine how well it works. Products with many features or services that provide superior performance are often thought of as "higher quality" – in fish trading, higher quality fish is measured in terms of colour, size, and weight;

-Conformance: the product is made or the service is performed to specification. Examples of conformance quality include degree of purity, the weight of a product, and the amount of time it takes to perform a service. In this research quality conformance means compliance with the EU quality standards;

-Reliability: a product will work for a long time without failing or requiring maintenance. A service operation performs its tasks consistently over time. In fish trading, reliability refers to long-term relations and trust among actors in the supply chain;
-Durability: whether or not a product can withstand adverse conditions, such as extreme temperature or rough handling;
-Safety: the product or service has been designed to be safe. Safety standards are an essential component of fish consumption.

Cost drivers are the structural determinants of the cost of an activity; they differ in the extent to which a firm controls them (Porter, 1985). Cost drivers determine the behaviour of costs within an activity, reflecting any linkages or interrelationships that affect it. Because operations and supply chain activities often account for the majority of the organizations costs, they are natural targets in cost reduction efforts.
The cost drivers of the fish value chain are subject to economies of scale. Economies of scale arise when a company is able to perform activities differently and more efficiently when handling larger volume of fish. Economies of scale imply that an activity operating at full capacity is more efficient if operating at a larger scale.
It is expected that all major problems can be linked to drivers of performance objectives.

4. The results of interviews and discussions

In order to understand clearly the growth of the Pangasius sector in Vietnam, a general description of the Pangasius life cycle will be presented next.

General description of the life cycle of aqua cultured Pangasius in Vietnam

Pangasius farming has been a means of livelihood of inhabitants in the MRD for more than 50 years. In the past, Pangasius did not culture in Vietnam as the adult fish spawn in Cambodian waters. Larvee migrate through the Mekong River to Vietnam and can be caught from May to July. Since 1995, Vietnamese farmers can artificially breed Pangasius in hatcheries
The life cycle of aqua-cultured Pangasius starts from selecting broodstocks in the hatchery. The hatchery workers will select good quality broodstock for artificial propagation. Eggs of the Pangaisus female and sperm of the Pangasius male are mixed and kept at a warm temperature until hatching. They are incubated for 18-24 hours in Zug jars (incubating machine). Immediately after hatching the fish are referred to as larvee. After a few days of nursing, the larvee becomes a fry. Fish fry prefers to eat small aquatic animals at early stages and soybean meal and fish meal later. After nine weeks, fish fry has grown to 10-15 cm (15g) and they are called fingerlings, which can be sold to fish farmers. Fish farmers buy Pangasius fingerlings directly from hatcheries or through fingerling traders who have a good relationship with fish farmers. Most fingerlings will be transported by boat to the farm gate. After 6 to 8 months of culturing, the weight of Pangasius reaches around 1-1.5 kg, and they can be sold to the market
Fish is sold either directly to the processing factories or via traders. The living Pangasius that meet

export requirements will be sold to processing factories where they are processed for export.

Results from the authors' survey show that most fish farmers sold their fish through traders as they produce in small quantities. The traders will classify the fish before selling to the processing factories. At the processing factories, fish are processed, filleted, frozen and exported to foreign importers. In the case of Pangasius that do not meet the requirements of the processing factory because they weigh less than 1 kg per fish, the meat is non-white, they contain residue of chloramphenicol, etc., the Pangasius will be sold to the domestic market. In addition to direct stakeholders, there are some indirect stakeholders who facilitate the activities of the direct stakeholders by supplying intermediate inputs and services.

Graph 1: Life cycle of aqua-cultured Pangasius

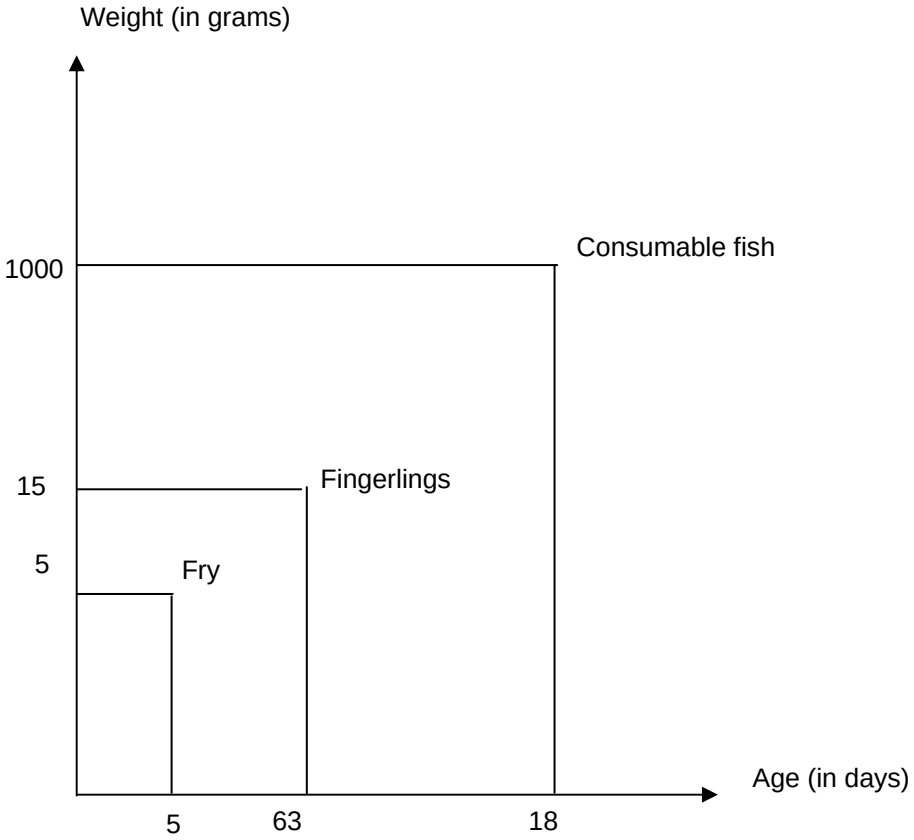
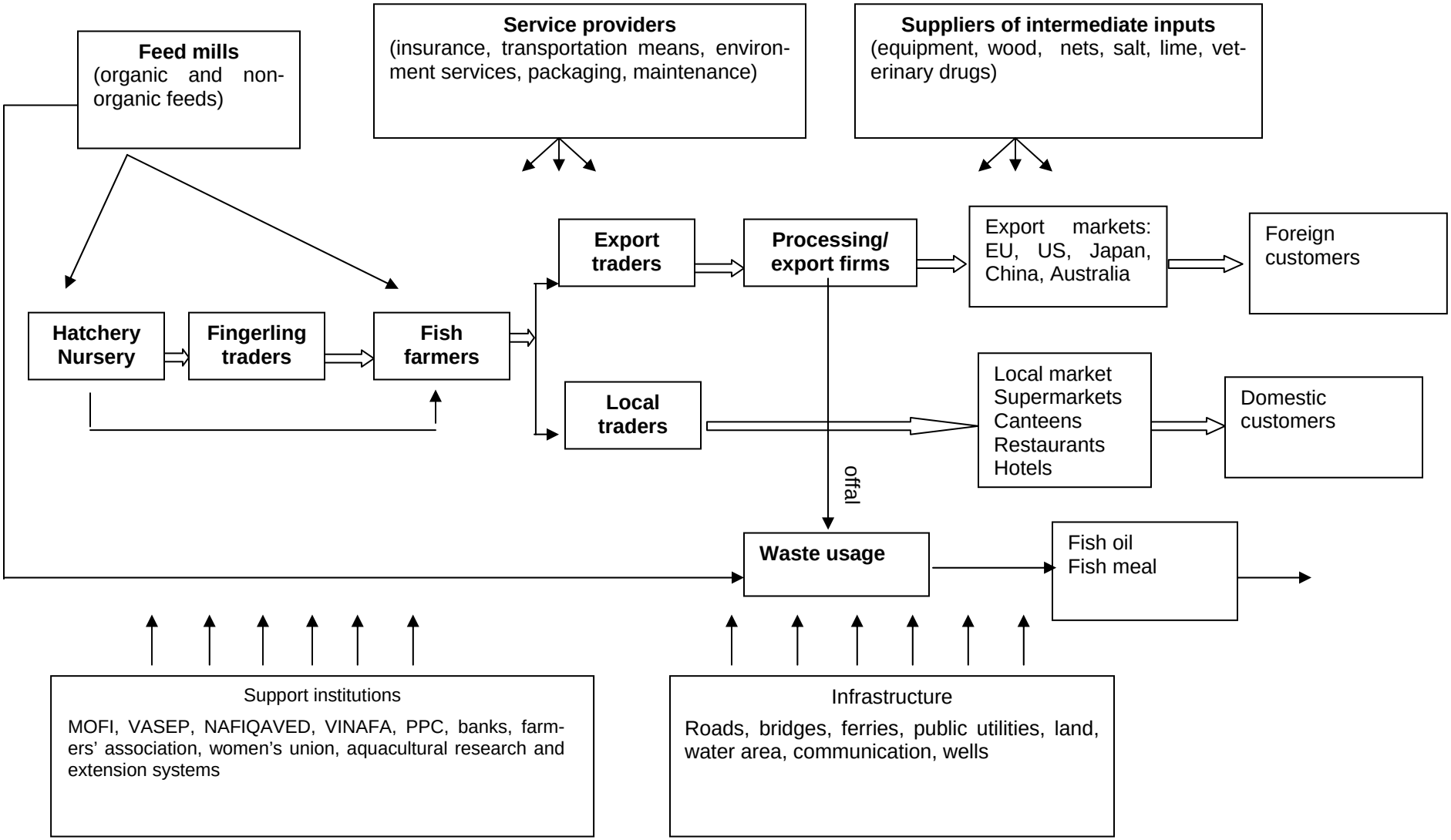


Figure 1: PANGASIUS VALUE CHAIN IN THE MEKONG RIVER DELTA, VIETNAM



Source: PACA (2004) and complied by author.

The supply chain of Pangasius is presented in figure 1. This figure summarizes the stakeholders who are directly and indirectly involved in the chain, from production to consumption both at the domestic market and at the export market for Pangasius.

In the value chain of the Pangasius, many actors participate in both primary activities and support activities. Primary actors who are directly involved in the transformation of inputs into outputs include hatcheries, fingerling traders, fish farmers, export traders, local traders, retailers, and processing/export firms. Supporting actors who facilitate the activities of the primary actors include feed mills, service providers, suppliers of intermediate inputs, institutions and infrastructure**.** This report will focus on analyzing the primary actors in the Pangasius value chain following the Porter model. In addition, the supporting actors will be discussed later.

4.1 The Results of the Interview with the Pangasius Hatcheries

Introduction

The aim of this part is to provide a general view on the hatchery operations in the Pangasius value chain. In this report, a hatchery refers to a place where fish fingerlings can be produced under controlled conditions. A hatchery can be a large investment that produces many kinds of fish, but a hatchery can also be a simple nursing farm used for breeding fish fry in small ponds. Nowadays there are hundreds of hatcheries and nursing farms in the Mekong River Delta, 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.

Private small-scale hatcheries and nursing farms smaller than 1 ha are popular in An Giang and Dong Thap. These are often family businesses and also produce large amounts of fingerling. State-managed hatcheries are often better equipped and are owned by the DARD of the MRD or by big companies from the fishery industry.

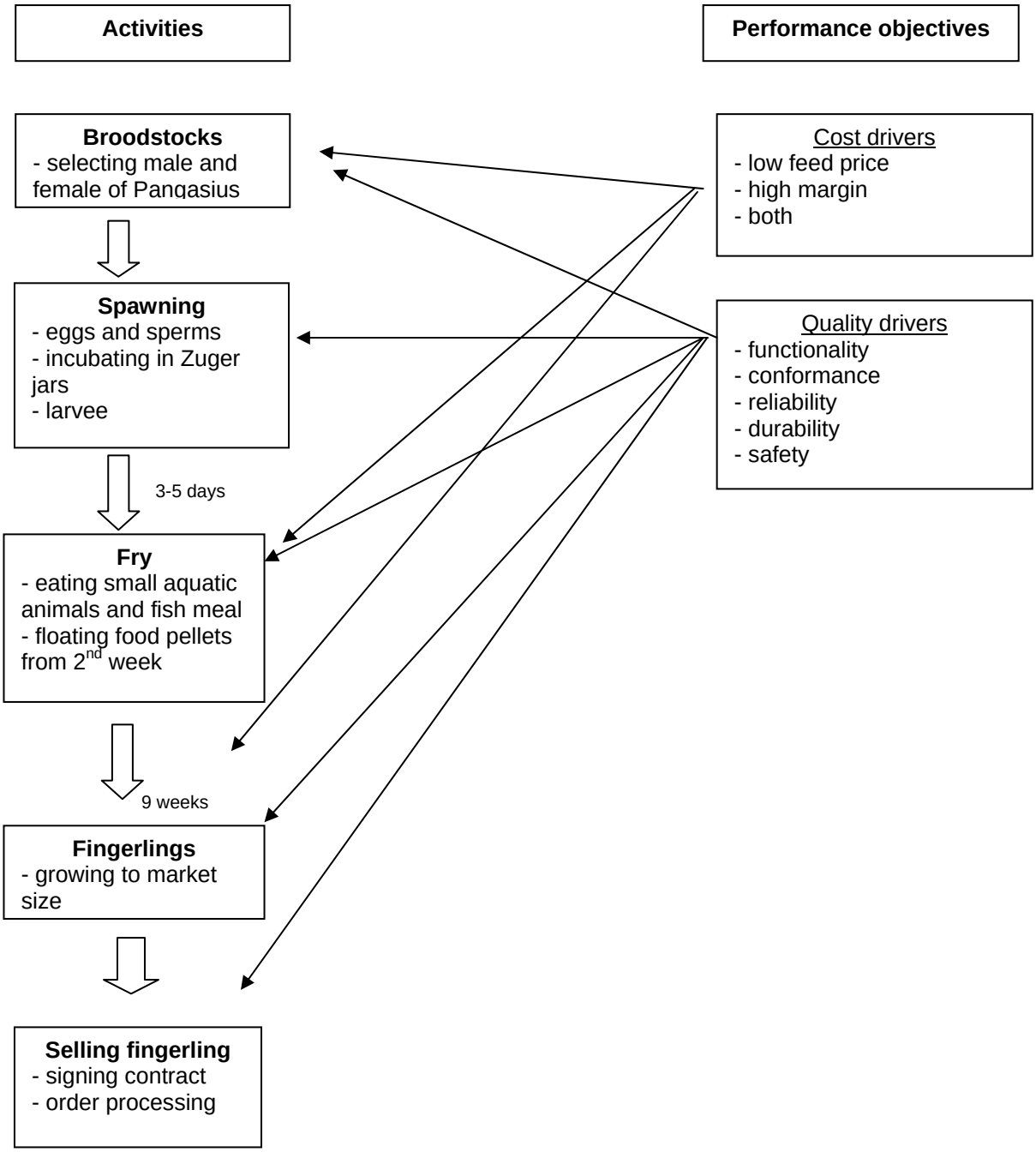
Big hatcheries are expensive to build and costly to run and maintain. To ensure the purity of the fish breed, the local governments of the provinces of An Giang, Dong Thap, and Tien Giang have established state-owned fish seed centers. The state-owned fish seed centers include the Dong Thap Fish Experimental Station, the Cai Be Research Center for Aquaculture in Tien Giang, the AG aquaculture research and hatchery production center in the An Giang province. The role of state-owned hatcheries is important: e.g. they conduct research on indigenous species, improved aquaculture techniques and maintaining quality broodstock. But three state-owned hatcheries can supply just 20% of the fingerlings for the MRD, which has led to many private hatcheries being active on the market now.

Four hatcheries have been surveyed and they can be classified into two types: state-owned hatcheries and private hatcheries. Information on the hatchery operation, as well as the management of bio-technological issues was collected in order to describe how the hatchery system works. Major economic indicators such as the productivity, the costs and the returns were also gathered. Perceptions and problem-solving methods used by the hatchery operators were collected. The supply of fingerlings by all hatcheries and nursing farms met the customers' demand (DARD, 2005). It is estimated that about 3 billion fry of Pangasius were produced in 2004 (Sinh, 2005). The hatchery will produce fingerlings as follows:

broodstock⇨ spawning⇨ fry⇨ fingerlings

The figure below will show the activities in hatcheries and the performance objectives that effect to the activities.

Activities and Performance objectives in Hatchery



Main activities and resources that are used in the hatchery

Main activities	Main resources	Performance objects
- **Broodstocks** + pond preparation + liming pond + feeding broodstock + curing	- develop broodstock from own strain - pond - water pump - feeds - veterinary	- cost drivers - quality drivers
- **Spawning** + fertilising the eggs	- eggs and sperm - incubating machine - circulation tank	- quality drivers
- **Fry** + feeding	- feeds	- cost drivers - quality drivers
- **Fingerlings** + feeding + stocking + selecting new generation broodstock + treatment if infectious diseases	- feeds - veterinary	- cost drivers - quality drivers
- **Selling fingerlings**	- fingerling sizes	- quality drivers

Primary activities

a. Inbound logistics

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

Artificial propagation of Vietnamese Pangasius was successful since 1995 and contributed to a rapid development of farming these species.

Now, there are hundreds the hatcheries in the MRD to produce Pangasius fingerlings. The Pangasius broodstock will be selected and restored for spawning. The hatchery has a pond for nursing broodstock. The pond should be good prepared by cleaning and liming before putting broodstock into in order to get good quality of broodtock. Broodstock will be fed nutritious feeds. Pangasius broodstock will be nursing at least six years before spawning.

b. Operations

The hatchery workers will select good quality broodstock for spawning (artificial propagation). Good Pangasius broodstock should be at least six years of age, weigh 5-8 kg, and be full-bodied with no visible signs of sores or hemorrhages. 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 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 larvee. A larve 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 that, the larve becomes fry. Fish fry prefer to eat small aquatic animals at an early stage, including a small water flee called moina and tubifex worms.

The hatcheries can buy moina from farmers who cultured them. Tubifex can be collected from the wild or bought from people who are specialized in this trade. Besides, the hatchery workers can also collect moina from ditches or canals in the surrounding areas by using a hand net. Tubifex worms can be found in polluted water canals.

During the first week, fry can be fed with home-made feed. The state-owned hatchery follows the formula as presented in Box 1. For preparation for feeds, the hatchery workers add soybean meal and fish meal while whisking egg yolks.

Box 1: Formula for home-made feed (first week)

Ingredient	Quantity/10,000 fry/day
Chicken egg yolk	20
Soybean meal	80g
Fishmeal	140g

From the second week onwards, the formula used to feed fish is as shown in Box 2 with the feeds preparation steps as cooked broken rice and fishmeal. These ingredients are mixed with other ingredients, and food pellets are made by hand or by using a mincer to extrude noodle-like feeds.

Box 2: Formula for home-made feed (Week 2 – 9)

Ingredient (%)	Week 2-5	Week 6–9
Fishmeal	45	30
Rice bran	28	43
Broken rice	8	8
Soybean meal	15	15
Vitamin & mineral premix (thyromine)	2	2
Robina powder–binder	2	2

Until the 9th week, fish fry have to grow to a size of 10-15 cm (15g). Then they are called fingerlings before they are being stocked in grow-out ponds or sold to fish farmers.

Source: AG Aquaculture Research and Hatchery Production Center.

c. Outbound logistics

Pangasius fingerlings are normally sold directly to fish farmers who come to the hatchery (usually by boat) to buy. The hatchery can also sell fingerlings in large volumes and different sizes of fish to the fingerling traders who distribute directly to the fish farmers.

Most of private hatchery operators sell their fingerlings to local fingerling traders. The fish farmers who live far from the hatchery usually buy Pangasius fingerlings from fingerling traders because they can supply any size of fish they want. Fingerlings traders are the most important actors in this complex network linking hatcheries and nurseries to fish farmers. Fingerling trading is a seasonal job and in most places it begins in April and ends in September.

Fingerlings are size-graded using a hole in a receptacle. The size of the hole depends on the order placed by the fish farmers. Fish that cannot pass through the hole are sold, while fish that do fit are considered as undersized and they turn to the pond to grow further.

Fingerlings are transported from the traders to fish farmers by boat, motorbike, or trolley. When transporting fingerlings from hatcheries to fish farmers, the fingerlings are stored in plastic bags filled with oxygen and water. The fingerlings will be transported in the early morning or late afternoon, when the temperature is cool. Then, the plastic bags are placed in pond water for 15 minutes to make the temperature inside and outside the bags the same; the bags are opened and the fingerlings are released into the nursing area.

The most common method of transporting fingerlings to fish farmers is by motorized boat. The reason for this is the fact that most fish farmers in the MRD are adjacent or situated near rivers. Motorbikes and bicycles are the second and third most popular methods of transporting small quantities of fingerlings. Specially modified three-wheeled and two-wheeled motorbikes (cyclo) and bicycles are used to move fish in small covered baskets and containers for short distances over land (own survey, 2005).

d. Marketing and sales

Most fingerling traders have a long–term relationship with the hatcheries. They can get a promotion in buying fingerlings with price guarantees and better quality, and often they may get prices that are 5% lower compared to the market price. This is done to secure a steady supply. Credit without interest is provided between fingerling traders and hatcheries with a period of 5–10 days after sales.

The price of fingerlings changes yearly but gradually increases as the result of an increasing number of fish farmers (Sinh et al., 2005). The price of fingerlings varies per size, species, season and with the price of Pangasius exports. The price is actually established on the basis of yearly supply of fingerlings and the degree of fingerling competition. The hatchery owners obtain price information mainly from other hatcheries and by studying the market themselves. In establishing the selling price of fingerlings, the hatchery owners consider the following factors which they perceive to affect the price of fish: (1) prevailing market price, (2) production and marketing cost involved, and (3) seasonality of supply.

e. Services

Now, the hatcheries are just supplying fingerlings to fish farmers without services after sale. Sometimes, the hatcheries give some guidelines as to how to breed fingerlings efficiently. Fingerling traders usually give 1% extra fingerlings to substitute for losses (e.g. with 10,000 fingerlings the farmers get 100 extra fingerlings) (own survey, 2005)

Support activities

a. Procurement

Most hatcheries are equipped with a pond, fishing net, Zuger jars, circulation tanks and water pumps. The Zuger jars are made of fiberglass. The size of the nursery ponds depends upon the land availability (Source: Aquaculture Faculty, Can Tho University).

b. Technology development

Now, the hatcheries that were interviewed are fulfilled production techniques. They just want to enlarge the capacity of their incubating machines to get more fry. In addition, the state-owned hatcheries want to follow the SQF (safe quality food) standard to guarantee the quality of Pangasius fingerlings and get a higher price (according to Ms. Van, Vice Director of the AG Aquacultural Research and Hatchery production center)

c. Human resource management

All hatchery technicians are young men (mostly 20-30 years old) with about 4-10 years of experience in hatchery operation. They have a BSc level training in aquaculture. If the owner cannot operate the hatchery himself, a technician is usually hired and he gets payed about 20-30% of the total net income of the hatchery. Some owners lease their hatcheries to the technicians who manage all activities in the hatchery. Typically, a contract is renewed and signed every year.

At the moment, about 70-80% of the technicians who are working in the hatcheries in the MRD come from the central provinces of the country (DARD, 2005). Most technicians have a BSc in aquaculture from Cantho University.

There are usually two to three people working in the small-scale hatcheries: the technician is responsible for the artificial propagation of the Pangasius and other persons will help the technician with preparing for the production of fish fingerlings.

The labour force for the medium and large hatcheries is three to four and four to seven workers, respectively. As an example we will look at the Binh Thanh hatchery. The hatchery is owned by the An Giang DARD situated on an island in the Hau River. The total area is 9 ha. The hatchery is a multipurpose facility equipped at present to produce the seed of the giant river prawn (Macrobrachium rosenbergii), tilapia (GIFT variety), and Pangasius. There are ten people working officially. For every kind of fish, there are two or three technicians who check quality and take care of artificial fertilization. The Tan Hung hatchery has a total area of 1 ha. There is one techician who is the owner of the hatchery and there are two official workers. In the fish season, the hatchery owners can hire more workers to help him (own survey, 2005).

d. Firm infrastructure

The production targets of hatcheries are determined by market demand from fish farmers and not by government policy. As the demand for fish fingerlings is rising rapidly, there are plans for building new plants, either as extra capacity or to replace older technology.

The availability of land, ponds, water, and labour is an important consideration in fingerling production. Large hatcheries are expensive to construct and maintain, and may quickly become redundant if fingerling networks develop (more nursery farms and fingerling traders). For state-owned hatcheries, a fingerling contract usually has to guarantee a certain volume of fingerlings available to fish farmers. However, one problem with such a contract is the fixed price. Fish farmers always focus mainly on the lower price, so they like to buy fingerlings from traders with oral contracts.

The fingerling traders are contracted to hatcheries and are paid in cash in advance before the fingerlings are received. The fingerling traders will take advantage if they make a contract with hatcheries before the fingerling season to ensure the fingerling supply. The contract is usually an oral contract for private hatcheries – they trust the fingerling traders. The fingerling traders will classify fingerlings in term of size to meet fish farmers' orders. (own survey, 2005)

Discussion of performance objectives in the hatchery

Before discussing the performance objectives of hatchery, we summarize them in a “house of quality” model.

Fig. House of quality of hatchery

	HOWs	
	Cost drivers	Quality drivers
WHATs		
Broodstock	X	X
Spawning		X
Fry	X	X
Fingerling	X	X
Selling		X

-Cost drivers: in the hatchery, it is difficult to separate certain cost items of stocking broodstock and rearing fry. Therefore, only the major costs or those directly made for broodstock were taken into account. The main cost comes from broodstock cost: it is the biggest expenditure during the cycle (41.9%), next are the feed costs for fry (40.5%); next is the veteriany drugs used. Hatchery operators can improve the economic efficiency by giving more consideration to these costs. These are three factors that affect fingerling quality directly.

Currently, the cost per Pangasius fingerling can range from 80–100 VND. Prices are based on the length of the fingerling. The table below shows the cost structure of the production of Pangasius fingerlings.

Cost structure of production of Pangasius fingerlings

Description	%
Total variable costs	100
of which:	
Broodstock costs	41.9
Feed costs for broodstock	1.5
Feed costs for fry	40.5
Veterinary drugs	7.4
Fuels and electricity	2.3
Oxygen and packaging	0.8
Annual equipment items	1.2
Transportation	0.6
Miscellaneous	3.84

Source: the An Giang Aquacultural Research and Hatchery production center.

In general, the seasonal changes in price of broodstock and fingerlings are important for the hatchery operators when making decisions on the optimal operation schedule.

-Quality drivers: in the hatchery, the broodstock quality is the most important factor. For a successful operation, farmers use the best broodstock available and provide proper care. Broodstock must be in good condition for optimal spawning success.

Water quality is the second important determinant for quality. In this area, diseases seem are directly linked to the poor water quality. Infectious diseases are a problem with all sizes of Pangasius, but they are particularly troublesome in fingerling production. The survival of Pangasius from fry to fingerlings varies strongly from pond to

pond and depends on the initial condition of the nursery pond and the occurence of infectious diseases. When all fingerlings have been harvested, the pond is drained and allowed to dry. The hatchery operators treat new water, which comes from the ground, with fertilizers (chemical or organic), salt and quicklime. Removing all the fish from the pond is important to prevent cannibalism of fry stocked in the new cycle of fingerling production.

The hatchery operators intend to establish and maintain long-term relationships with their buyers e.g. fingerling traders, nursing farmers and fish farmers. To do this, the hatchery workers try to deliver fingerlings on time, meet the demand orders, and try to realize a good quality with a high survival rate. Fish yield and stocking densities for Pangasius fingerlings are extremely variable and vary according to the system of production used. Increasing stocking density is associated with a higher yield and higher costs, but gives a lower marginal profit per kg of fish and a higher level of risk. Young fry are stocked mainly depending on the size and the quantity of fingerlings desired at harvest; stocking densities from 20,000 to 70,000 fry per hectare are common. It is a guarantee for the quality of fingerlings.

Estimated number (kg) of broodstock of Pangasius for producing 1 million fingerlings

Average weight of females		5 kg
Number of eggs per 5 kg of female (F)		500,000
Fertility rate of eggs 80%		400,000
Hatching rate of fertile eggs 80%		320,000
Survival of larvee up to 5 days 70%		22,400
Survival of fingerling up to 1 month 60%		13,440
To produce 1 million fingerling :	1,000,000 : 6,720 = 74.4 kg F	
Real number of females 74.4 kg;	males 148.8 kg (with ratio 1 : 2)	
Estimated resource 20% 14.88 kg;	males 29.76 kg	
Females 89.28 kg	males 178.56 kg = 267.84 kg	
Estimated amount of broodstock: 267.84 kg		

Source: DARD of An Giang, 2004.

-Successful factors: the most successful factor in hatchery is broodstock management. The fact is that the broodstock used for propagation in the hatcheries is often in poor condition and not suitable for producing quality fingerlings. The quality of broodstock causing a poor supply of fingerlings can negatively influence the fish production on both large- and small-scale levels. The selecting of young broodfish from a consolidate population should follow the system of positive mass selection where the largest individuals with the correct body shape, colour and scaliness. 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. In addition, broodstock should be fed throughout the year to supplement natural food sources and to maintain sustainable conditions. Supplement feeding is necessary to regulate growth, keep the fish in good condition and prepare and activate them for reproduction.

Hatcheries that produce Pangasius fry are simple facilities that use single-pass, flow-through tanks for egg incubation and fry rearing. The second factor for a successful hatchery is a dependable supply of high-quality water. Perhaps the most important characteristic is the temperature. Most hatcheries revealed that fingerling quality, management and administration, transportation and stocking are factors that affect the success rate of the hatcheries. Most hatcheries do not maintain the genetic quality of their broodstock due to inappropriate management. Breeding fish is not difficult although it does require specialist equipment (such as fish breeding

hormones). More extensive training and experience is required for successful fry nursing. Hands-on training is the best way to teach people how to breed and nurse fish. In addition, many private hatchery and nursery operators use pesticides and other dangerous chemicals. It is advisable to monitor this use. The introduction of exotic fish should be controlled to reduce the risk of diseases and negative environmental consequences.

The responses to the question “What are the crucial problems in hatchery operations?” first show that there are no problems concerning supplying fingerlings to farmers. The fingerling production network can now guarantee sufficient hatchery-produced seed to meet the demand of the Pangasius culture in the MRD of Vietnam. There are some problems due to the fact that the quality of Pangasius fingerlings is not guaranteed, because many small-scale hatcheries are active in the region and the local authorities can not control all of them. Accoring to Ms. Y. Van, technician at the Binh Thanh hatchery, the quality of fingerlings is not guranteed. Especially for private hatchery and nursery, the fry survival rate is 60% or less. The reason why that before the year 2003, the spawning season for Pangaisus was only once a year from April to July. After 2003, the demand for cultured Pangasius increased, and the fingerling producers introduced spawning throughout the year. The hatcheries try to use more chemicals and give more feeds to the Pangasius female in order to make artificial fertilization possible more often. This has led to a decrease in the surviving fry and quality of fingerlings. The overuse of broodstock in the hatcheries led to a higher use of veterinary drugs. Another problem is the diseases of the fish caused by the quality of feeds and water. If the quality of public water is better, the survival rate of fingerlings can be improved and that can help to save much money which is now spent on fish health management.

4.2 The results of interview Pangasius farmers

Introduction

The aim of this part is to provide a general view of the fish farmers’ operations in the Pangasius value chain. The system of Pangasius farming in the Mekong Delta is characterized by fish cages and ponds located along the Hau River in the provinces of An Giang and Dong Thap. According to DARD in 2004, in the MRD there are more than 15,000 households raising Pangasius either in cages or in ponds.

The rapid growth of Pangasius products for export has opened an opportunity for Pangasius farming. Besides An Giang and Dong Thap, Pangasius farming has spread to other provinces in the MRD such as Can Tho city and the provinces of Vinh Long and Tien Giang. Most of the fish farmers we interviewed told that they had been in this line of business for a long time. In fact, many households began catfish farming before 1970, (eight out of ten households in An Giang and three out of five households in Can Tho) with a majority of them inheriting the business from their parents. At that time, the fish was just sold at the local market. Fish farming is often seen as a suitable livelihood activity that fits around the family structure. The family house is usually located near the cages or ponds with all family members playing a vital role in the daily husbandry and maintenance of the fish farm and livestock.

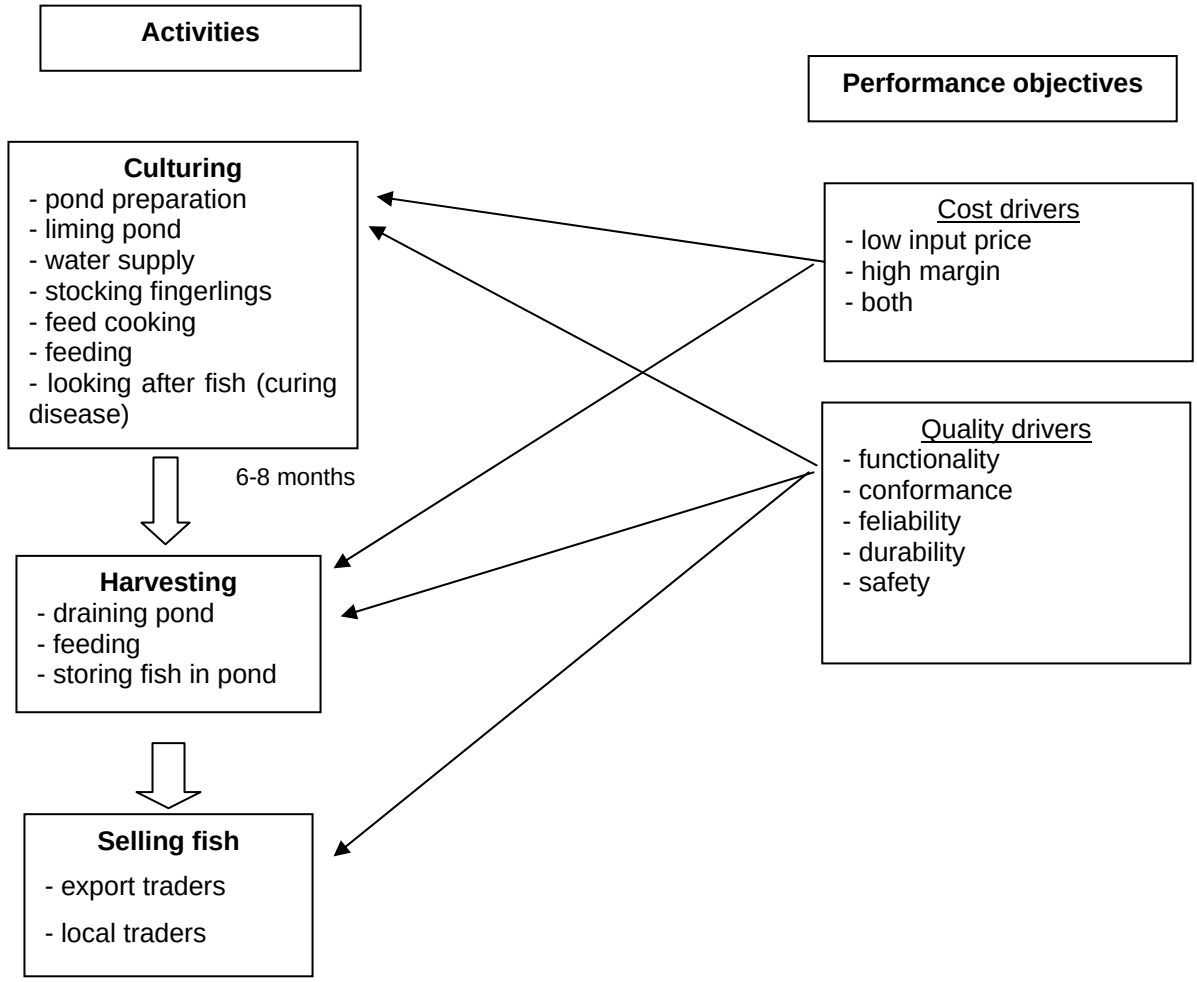
The activities of fish farmers are simple. Everyday, they feed fingerlings at a fixed time. Most fish farmers (95%) use home-made feeds that include trash fish, rice bran/broken rice and soybeans, other use industrial feeds that are more expensive and lead to higher costs. We have surveyed 15 fish farmers, who have been classified into two types: pond and cage farming. Information on Pangasius raising as well as the management of biotechnological issues was also collected in order to describe how the fish farmers work. Information on major economic indicators such as the productivity, costs and profits has also been collected.

People said “No” to the question “Would you give up this occupation and move to another one in case the Pangasius trade is banned and there is a failure of market?” Most of them said, “We are only familiar with this occupation and we make a living out of this, how can we give it up?” or “how can we stay alive if we give up this

occupation? We do not have land and do not know anything about farming or any other occupation" (own survey, 2005).

The figure below shows the activities of fish farming and the performance objectives that affect the activities.

Activities and performance objectives in fish farming



Main activities and resources that are used in fish farming

Main primary activities	Main resources	Performance objects
- Culturing + pond preparation + liming pond + water supply + stocking fish + feed cooking + feeding + looking after fish (curing diseases)	- fingerlings - pond or cage - feeds: trash fish, rice bran, soybeans - water pump - grinding machine - feeding platform	- Cost drivers - Quality drivers
- Harvesting + draining pond + feeding + storing fish to wait for a higher price	- seine - fish	- Cost drivers - Quality drivers
- Selling consumable fish + export traders + local traders + processing firms	- consumable Pangasius	- Quality drivers

Primary activities

a. Inbound logistics

The fish farmers usually buy the fingerlings from the fingerling traders in who live in their province or other provinces, but mostly in An Giang and Dong Thap provinces. The fish farmers only buy healthy fingerlings of 10-15cm in size. Healthy fish have a bright colour (dark green on the dorsal side, silver on the ventral side and clear stripes on the lateral side), and they do not have any body deformation, injuries or damaged fins. Currently, some fish farmers stock fingerlings in ponds when the price of fingerlings decreases for the next season, so they can make another profit from the difference in the price of fingerlings (Own survey, 2005)

b. Operations

The system of Pangasius farming in the MRD is characterized by fish cages and ponds located along the Hau River. To understand the process of pond culture, I interviewed my father (Mr. Khen) who had a lot of experiences in Pangasius culture. This part will describe the facilities required for Pangasius pond culture, methods of pond preparation, feed and feeding, and harvesting methods.

Facilities required

* A pond: Pangasius can be grown in any size of pond, but ponds of at least 500m2 are ideal. Preferably, ponds should be rectangular with 1:4 or 1:3 length to width ratio. This shape makes it easy to harvest fish with a seine. The ponds should be 1-1.5m deep and should have a water inlet and outlet. Raised dikes or net fences around the ponds help to protect the fish during floods, especially in the An Giang and Dong Thap provinces.

* Pond preparation

The ponds should be prepared for a new culture cycle by using the following steps:

- cut grass and clean the pond dikes;
- drain water, remove black organic sediments;
- apply quicklime at a rate of 100-150g/m2 to correct acidic conditions and kill bacteria;
- use rotenone (derris root) at a ratio of 3g/m2 per pond surface area to eradicate unwanted aquatic animals, then sundry for two to three days;
- fill water up to 1-1.5m in depth through a mesh screen.

Now we are ready to stock fish.

* Stocking: the fish is transported in either the early morning or late afternoon, when it is not too hot. The plastic bags with the fish fingerlings are placed in the pond water for 30 minutes to make the temperature inside and outside the bag the same. The bags are opened and the fish are released into the pond. Although fish can be stocked with as much as 25 fish per square meter, if you stock about eight to ten fingerlings per square meter it is easier to reduce the risk of failure. The maximum fingerling can be estimated by multiplying the pond area by 10.

* Feeding platform: Pangasius are vigorous eaters; once the feed is presented, the whole school lunges towards the feed, which makes turbulent waves that waste feed. Installing several feed platforms along the pond dikes is useful to reduce feed waste. These feeding platforms can be made of any type of wood;

* Home-made feeds: The feed mixture is placed on the feeding platforms using the following rates as guidelines. The feeding is a mixture of trash fish, rice bran and soybean. The amount of feed is reduced if the fish do not consume the food within 30 minutes. Similarly, the amount of feed is increased if the fish finish the food quickly. The amount of wet feed required for 1m2 pond stocked with eight fish per square meter is shown in Box 2.

Box 2: Feeding rates for different fish stages

Month	Kg wet feed
1-2	40
3-4	110
5-6	160
7-9	200
10-12	320

* Looking after fish: Feeding behaviour of the fish can be observed at the feeding station. If they feed vigorously, it indicates that they are healthy. If any abnormal behaviour is noted, the reasons must be discussed with the extension officers who will provide production techniques to the fish farmers. Antibiotics should not be used indiscriminately before it is known whether the abnormal behaviour results from a bacterial disease.

* Harvesting fish: A seine can be used for the partial harvesting of fish. Fish ponds should be drained to harvest all fish. Fish can be harvested any time after eight months depending upon the size that is preferred. Fish may reach a weight of 0.6-0.8 kg in eight months and 1-1.5 kg within a year. (See the appendix 3 for the Pangasius culture process)

c. Outbound logistics: this activity is integrated with marketing and sales

Fish products are mainly sold at farm gates to traders or processing companies. At harvest, it may take fish farmers several days to sell off the fish products depending upon how much fish they have. The fish farmers usually sell fresh Pangasius to one of three following buyers: collectors of processing companies, export traders and local traders (its definition in traders' part). During the harvest (season), the production schedule is adjusted (less feed inputs, purchasing new fingerlings, etc). Fish ponds or cages are the useful storage facilities that can reduce market price pressure or fluctuations and keep the products alive or fresh to better serve customers.

In general, fish farmers raising Pangasius sell them to augment their income. Factors affecting farmers' decisions on marketing harvested fish highly depend on: (i) the financial condition of the household, (ii) the seasonality and size of the fish, and (iii) the prevailing price of fish on the market. If the farmers have financial problems, they tend to sell more of their fish earlier than usual. On the other hand, when the market price is not that good, fish farmers tend to keep fish for a longer period of time as they wait for a better price on the market.

Fish farmers get market information mainly from neighbours, through the telephone and from traders. Fish farmers tend to sell their fish to the buyer who offers the highest price. Now, at the harvest, the fish farmers usually ask the company to come to the farm gate to check the fish quality. The company staff will go directly to the farm household to take five fishes and bring them back to the company to check the quality. After that, the fish farmers will know the quality of their fish. If the fishes are strong and do not have any diseases, the company will buy them after having negatioted on the price. Sometimes, the fish farmers will give second priority to their regular buyers. Regular (fish) buyers have a good relationship with the farmers.

d. Service

Although fish farmers tend to have some kind of special relationship with their buyers, not one showed any special credit or service arrangement between the two parties involved.

Support activities

a. Procurement activity is integrated into the investment in the Pangasius culture

The equipment for breeding Pangasius is simple. The fish farmers need a pond or cage. In addition, the material for culturing fish include a water pumping machine, a grinding machine, rice bran storage, the costs of a veterinary, trash fish, soybeans and fuel.

b. Technology development

Besides their great experience in aquaculture, the fish farmers tend to attend courses on production techniques. They also watch a television program called "The bridge linking Farmers" to study production techniques.

c. Human resource management

Pangasius pond farming takes place in ponds with surfaces ranging from 0.2 to 1 ha. Each pond requires two to three labourers who take care of cooking food and feeding the Pangasius. The cage size of (14 x 7 x 5 m) also requires at least two labourers who take care of cooking food and feeding the fish. Raising fish in cages or in ponds requires only one person who specializes in fish breeding. Other persons will help him to care the fish.

d. Firm infrastructure

The Pangasius culture can be started all year round, depending upon when the marketable size of fish is sold to empty the cage or pond for new stock. Credit is crucial to fish farmers since they need money to buy feed. They can get credit from the bank or another informal organization with a higher interest rate.

During the harvesting season, the farmers tend to sell products to anyone who offers a higher price. Fish farmers have been accused of breaking contracts when higher prices are offered by traders.

Discussion of performance objectives of fish farming

Before discussing the performance objectives of fish farming, we summarize it in a "house of quality" model.

House of quality of fish farming activities

	HOWs	
	Cost drivers	Quality drivers
WHATs		
Culturing	X	X
Harvesting	X	X
Selling		X

-Cost drivers: In general, the farming of commercial Pangasius requires a high level of investment. A huge amount of money is needed to construct cages or to buy land for ponds (see cost-benefit analysis below). Results from the latest studies in the Dong Thap and An Giang provinces (the two biggest Pangasius producers of Vietnam) conducted by the College of Aquaculture and Fisheries at Can Tho University from 2003 to 2005 show the three most main components of the Total Variable Costs (TVC) for farming Pangasius. They are: (i) the feed costs often amount to 65-85% of TVC, cage culture being less expensive compared to pond culture; (ii) the cost of fingerlings amounts to 5-25% of TVC, with cage culture being more expensive because the stocking density is 5-6 times higher than that of pond culture; and (iii) veterinary costs were 3.5-10% of TVC, with cage culture costing more due to the water flows and higher stocking density.

Mr. Tuan (2004) observes a significant decrease in the percentage of the total number of successful farmers who made at least some profit from the Pangasius culture. This percentage was 87% in 2001 and went down to 76.4% in 2004. He also reports that about 30% of the total number of cage farmers made a negative profit while this number was 20% for pond farmers in 2004. This was explained mainly by the increasing price of major inputs such as fingerlings, trash fish, fuels, the chemicals/drugs as well as the decreasing price of outputs.

The increase in fixed costs is mainly due to the price of land and materials for pond/cage construction. After five years from 2000, the price of materials for cage construction became two to three times as much while the price of land for pond culture increased by three to five times.

Sinh (2005) estimates an increase of 15-20% in the production costs for farming Pangasius from the beginning of 2003 to the end of 2004. The price of fuel had increased about 40% after six months from the beginning of 2005. However, the average price of output (fish or fillet size) fluctuated from VND 13,000-15,000 per kg at the end of 2003 to VND 15,000-17,000 per kg in 2004, and then went down to VND 11,000-13,000 and VND 8,000-10,000 at the beginning and the middle of 2005, respectively. It is roughly estimated that no less than 50% of the Pangasius farmers have obtained a negative profit for their crop in 2005 (DARD, 2005).

On the basis of the calculation of DARD of the An Giang province, 2004, we can make the cost and benefit analysis of raising Pangasius.

Production cost of Pangasius raising on cage

* Basis of calculation:

- Size of raising cage (14 x 7 x 5 m)
- Size of breed: body height of 2.5 cm, average weight of 0.075 kg per piece (about 14 per kg)
- Average price of breed: VND 1,400 a piece
- Average price for (of ?) feed: VND 1,800 per kg
- Feed coefficient: 3,0
- Raising duration: 8 months. Output: 40 tonne

* Production costs:

- Breed cost: 40,000 pcs x 1,400 VND per piece	= 56,000,000
- Feeding cost: (40,000 kg - 3,000 kg) x 3 x 1.800 dong per kg	= 199,800,000
- Cage depreciation: 200,000,000 dong x 10%	= 20,000,000
- Labourer wage: 500.000 dong/month x 2 labourers x 8 months	= 8,000,000
- Fuel cost: 20 l x 40 t x 3,800 dong	= 3,040,000
- Disease prevention and treatment cost	= 10,000,000
- Fixed asset depreciation (equipment, machines) and other costs:	= 5,000,000
- Bank interest: 200,000,000 dong x 70% x 1% x 8 months	= 11,200,000
- Business registration tax and other fees:	= 1,000,000
Total cost:	= 314,040,000

Production cost excluding wastes: 314,040,000 dong per 40,000 kg	= 7,851 dong/kg
Cost of waste (40,000 kg x 10%) x 7.851 dong	= 31,404,000
Production cost (314,040,000 dong + 31,404,000)/40,000	= 8,636 dong/kg

Thus, the production cost of a Tra fish raised in a cage is 8,636 dong per kg.

The minimum price that processing companies to buy based on the consumption contracts must be: 8,636 dong + 20% of 8, 636 = 10,363 dong per kg

Cost-benefit analysis

Initial investment costs. The largest initial investment is the construction of the cage. The cage is the place where the fish farmers raise the fish and live daily; Therefore, this is the home of the farmers in the MRD. The cost of a cage depends on the size of the cage and the materials used to make it. For a cage to support a capacity of 30 tonne, the cost is around VND 100 million (US$6,579). A 60 tonne capacity cage costs around VND 200 million (US$13,158), and a 100 tonne cage costs VND 350 million to VND 380 million (US$23,026-25,000). Normally, farmers use their accumulated savings to make cages. The cage is then used as a collateral to borrow money from the banks (given that the cage is registered at the local authority).

In addition to the above costs, farmers have to buy other machinery and equipment such as the feeding machine (VND 3 to 4 million or US$196 to 261) and a bran cooking and blending machine (VND 5 to 6 millions or US$329-395).

-Cost of fingerlings: Farmers raise either Basaor or Tra fish. The price of fish breed depends on the size of the fish. Young Basa is around VND 3,500 a piece (US$0.23), while young Tra is only VND 500 to VND 1,500 (US$0.003-0.009) a piece. In some cases, the cost of one young Tra fish was only VND 290 (US$0.019).
-Feeding cost: Fish feed is processed locally by the farmers and comes from local sources; it includes broken rice and bran, maize, morning glory, china squash, sweet potato and sea fish (sardine, long-jawed anchovy, etc) or fish powder, which costs VND 2,000 per kg. During the monsoon, there are plenty of mixed fish species in the river, and the fishing farmers can easily pick them up and use them to feed the fish. Thanks to the above-mentioned factors, the average cost of self-processed feed is only VND 1,800 to 2,000 per kg. The cost is even lower when the Tra fish is raised in ponds. Farmers calculate that to get one kg of finished fish products they normally spend around 3 kg of feed for Tra fish and about 4 kg for Basa.
-Labour cost: The owners normally hire two labourers for each cage. They come from the local area. However, in the Vinh Long province, most of the fish cages and ponds owners have to hire labourers from An Giang because not many local people have good knowledge and the required skills for fish raising. They have to work hard from the morning to the night because they have to feed the fish a number of times (five to six times) a day. The wage of each labourer is around VND 550,000 to 700,000 (US$35.94 - 45.75) per month excluding meals, or VND 750,000 (US$49.02) per month including meals. Besides, “every day I have to give each of them VND 4,500 to 5,000 (US$0.29-0.33) a day for breakfast, coffee and cigarettes” (own survey). In addition, at the end of the fishing season the owners have to pay their labourers a bonus, which can be as much as some millions of VND per labourer.
-Cost of loan: The farmers normally mortgage their cage to secure loans from the Bank for Agriculture, and the Industrial and Commercial Bank, or to borrow from the processing export companies. The interest rate of banks is around 0.75% per month and that of companies around 0.85 to 0.9 % per month. The duration of these loans is 6 to 12 months (as long as the fish season lasts). To obtain the loans from a company, the farmers have to sign sale contracts with the company. The farmers borrow a large amount of money to buy breeds, feeding, etc. In addition, some farmers have to borrow additional money with high interest rates from private lenders (traders). In such cases the interest varies from 2 to 3% per month (in some cases 4%). The loan is used to maintain the cage, purchase feed, repair and maintenance of the machines and equipment, etc. This makes them vulnerable, and they may tend to agree on a lower price for their products during the harvest season.
-Miscellaneous costs: Apart from the above-mentioned costs, the farmers have to bear additional costs concerning disease prevention and treatment, fuel costs, heating materials, etc (to run the feed processing machines), and business registration tax (from 100,000 up to 1,000,000 dong, depending on the number of fish cages). The total of these costs adds up to several millions of dong each season.

These costs differ a bit from one owner to the other. Some households raise fish at the cost of VND 8,000 per kg (US$0.52), but for some others the cost “can’t be less than VND 10,500 per kg”.

-Quality drivers: Pangasius farmers are obliged to implement proper technical methods and criteria because of two main reasons. First, the biological character of the fish is very sensitive to water, weather, food and care. Second, the farmers have to pay a large amount of money - hundreds of millions - if there are shortcomings, loses in the

process of raising. Sometimes they must stop raising. All the households interviewed, followed strictly the rules and regulations of quality management but they were not much aware of the permitted or prohibited medicines as prescribed by the Ministry of Fishery. Some households paid veterinarians from the research centers of the Research Institute of Fishery Farming N02 or the University of Can Tho for training and support. To get accepted by the exporters and processors, each Pangasius cage or pond needs to meet the food safety and hygienic standards. Each cage will be checked at least two times: after two months of culture, and one month before harvesting. Besides, the seasonality and the weather are also important factors for the fish quality.

Currently, the farmers usually buy the fingerlings from the supplier with whom they have had a good business relationship and they rely on the quality of the fingerlings. The reason why fish farmers choose the suppliers with whom they have a good relationship is that fish farmers can choose the fingerlings more easily and return the fingerlings of poor quality. And in the process of transporting fingerlings to the households' gate, the fingerling traders always guarantee fish quality within 7 days if the quality of the fingerlings is not up to standard. Besides, if fish farmers buy fingerlings from a hatchery, they need facilities to transport the fish to their farm. And this is difficult for fish farmers who live far away from hatcheries and buy small quantity of fingerlings. They can suffer a great loss in transportation.

In selling activities, the fish farmers tend to maintain long-term relationships with their traders because to them market price is the most important. The exchange of market information is considered important in business relationships. Therefore, the farmers will sell products when they think their fish is at its best. They will also try to get a contract with a processing company to sell quality products in order to get good a relationship.

-Successful factor: Pangasius farming is a traditional occupation of livelihood in the MRD. In most of the provinces, such as An Giang, Dong Thap, Can Tho and Vinh Long, farmers make a living with Pangasius farming. So, they have a lot of experience and techniques in breeding Pangasius. Since 1995, the successful artificial propagation as well as the expansion and improvement of marketing of Pangasius products have led to a rapid development of farming activities. Pangasius farming has created jobs for thousands of labourers including those who are working in the processing factories and export companies.

In addition, good physical natural conditions and traditional fish-eating habits lead to a high potential for the aquaculture development in Vietnam, especially in the MRD where there are different types of wetland. The natural conditions of the MRD are very favourable to fish farming. The water current of the river is fast, which helps farmers to raise fish with a high density and realize a high productivity. The climate in the MRD is warm and tropical, which is most suitable to raise fish all year around. The fish farmers can start fish farming at any time of the year. In addition, the farmers use their family as labour to save money. This helps them raise fish at a low price.

The responses to the question "What critical problems do you have in farming operations?" first show that there are many problems in culturing Pangasius, but they focus on some big problems. The financial condition is a major constraint for fish farmers, who need large amounts of money to construct ponds or cages. Moreover, a large number of farmers cannot afford to purchase feed for their fish. There are some private loan systems with high interest rates. The average interest rate is 3-4% per month, which can completely eliminate the profit margin for the fish farmers.

The second problem is the fluctuation in market price which leads to a loss for the farmers. Most of the interviewed fish farmers said that they had borrowed loans from the banks, namely the Bank of Agriculture and Rural Development, and the Vietnam Commercial Bank, and from private moneylenders. When the Pangasius prices dropped many small farmers suffered from losses. Some of the interviewed households were pushed into a

situation of insolvency by returning their loans to the banks. These households had to ask for support by the local authorities or the An Giang Fisheries Association to convince the banks to extend the loans so that they could continue their work. Due to loss and for their prestige, they tried to repay first by selling land or houses, or by borrowing money from other sources. The farmers were unable to pay back long-term debt; in addition, the bank insisted on reclaiming the loans.

The third problem was that the fish farmers did not have enough information and proper aquaculture production skills. Most fish farmers received information from other fish farmers and this information source is not reliable. They need technical assistance programs to guild them proper aquaculture production skills and market information. Currently, fish farmers who are the most vulnerable are the people who suffer the greatest loss, because there was no institution to protect them (e.g. the institutions which are strong enough to secure fish farmers). Moreover, fish farmers have no access to information and knowledge about potential risks of international trade. For example in the case of the "catfish anti-dumping case" that led to a drop in the price of Pangasius. All of the interviewed people said that they did not know anything about it until it was mentioned by the media and the Pangasius price went down. Farmers also expected that the export companies would carry the load of difficulties with them in difficult circumstances. Many of the farmers were not satisfied with the fact that the poor were the main victims while the enterprises did not suffer the same loss.

The market price for farmed fish, especially in relation to the cost of input is the fourth problem. The significantly increasing price of major input such as fingerlings, trash fish, fuels and veterinary drugs leads to a higher cost of production.

The fifth problem is the environmental pollution. Waste from the factories is not fully processed before disposal, leading to a stench surrounding the factories. In addition to this problem, solid waste from the fish cages (e.g. trash and other kinds of waste) are disposed directly into the river. There is a need to improve awareness of environmental protection to avoid pollution and fish diseases.

In short, the quality of the fish is the most important factor in Pangasius farming. A good quality of fingerlings helps fish farmers to shorten the duration of culturing; reducing the costs of veterinary drugs and getting a school of fish with a more homogeneous weight and size leads to a faster sale.

Fish farmers need to prepare and clean ponds and cages before the beginning of each crop. Cleaning is very important for the fish quality. Liming is the next aspect fish farmers are concerned with. The source of fingerlings is also an important factor and checking the quality of fingerlings is another important activity. In other words, the fish farmers need a large capital to culture quality fish. Feed is also important. Checking feed helps to uphold the water quality and also to save the feeding costs. Moreover, water management is important for the fish quality. Most fish farmers commented that the health of the fish was an important factor for water management. The strong and annual fluctuation of fish prices in recent years have been the key concern for the fish farmers, and they said that this factor strongly affects their profit. Because consumers require better quality of fish, most fish farmers paid attention to the health and the quality of the fish.

4.3 The Results of the Interview with the Pangasius Traders

Introduction

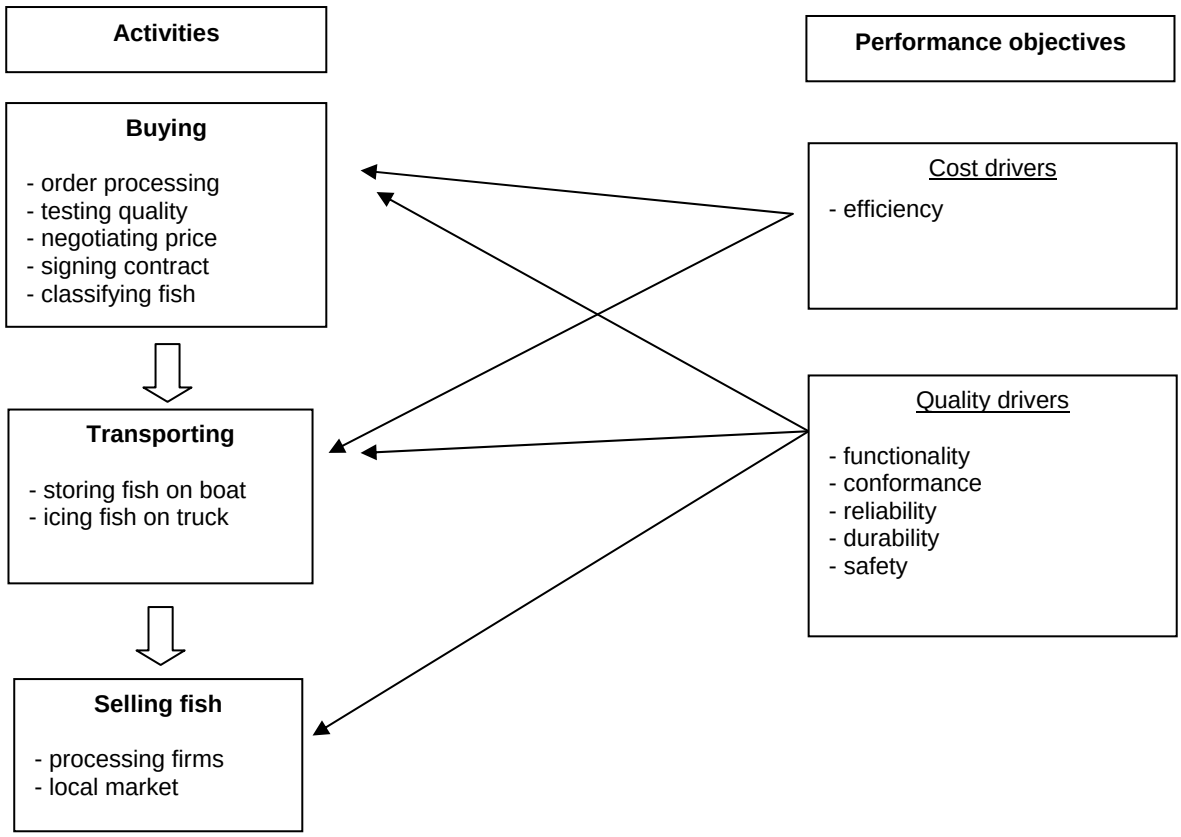
The aim of this part is to provide a general view on the fish traders' operations in the Pangasius value chain. In general, most traders use boats to buy large volumes of Pangasius at farm gates. Then, they classify them in terms of sizes and quality and deliver them to a processing factory within and outside the province. In the case of Pangasius that do not meet the requirements of the processing factory - e.g. because a fish weighs less than 1 kg, its meat has a non-white colour, it contains residue of chloramphenicol, etc. - the Pangasius will be sold to

domestic markets in Ho Chi Minh city, Can Tho city, the Long Xuyen and Vinh Long provinces. There are hundreds of traders who operate and supply fresh Tra fish to local markets in the MRD. In fact, there are many kinds of collectors and traders in the fish market chain. It is classified into three main collectors and traders:

- The collectors, who are the staff of the fish processing/export companies. They usually buy Pangasius from the farmers on the basis of the growing cycle or a fixed schedule. Fish prices are based on the export market demand and on the quality that the processing companies look for, such as colour, size, weight, etc. In fact, farmers sold fish to these collectors under contract between farmer and company.
- Export traders may be either authority traders of a certain export processing company or “free” traders. For the authority traders who belong to the export company, they usually base on the plan of processing for export of company such as quantity, price of fish within a week and they will come to everywhere to look for and buy fish from the farmer. Normally, these traders have a force of local brokers and pay them a commission fee, so that it is easy for them to do in business via telephone. Beside, for the free traders who can sell fish to any company for an appropriate price and business conditions. They do not depend on a company or organization (in the business process), but it is very difficult for them in case of abundant fish supply. They will have more risks concerned to look for consumption markets; in some cases, they have to sell to the wholesalers at local markets at a low price although their fish did actually meet the export requirements.
- Local market traders who deliver fish regularly to the network of wholesalers at local big markets in the MRD such as Long Xuyen, Can Tho, Vinh Long and Ho Chi Minh city. The fish is transported by boat. In general, this kind of fish never meets the export requirements of the company. For example, the fish may weigh less than 1 kg a piece, it may have a non-white colour, etc. Therefore, the price of fish is just 60-70% of the price for export fish.

We surveyed five fish traders. Information on Pangasius transportation as well as on the management of quality issues has been collected in order to describe how the fish traders work. Information on major economic indicators such as the costs and profits were also collected. The figure below shows the activities of traders and the performance objectives that affect the activities.

The activities of Pangasius trading will be described as follows.



Main activities and resources that are used in trading

Main primary activities	Main resources	Performance objects
- Buying + order processing + testing quality + price negotiation + signing contract + classifying fish	- cash - credit - group of traders	- Cost drivers - Quality drivers
- Transporting + storing on boat + icing on truck	- boat - truck	- Cost drivers - Quality drivers
- Selling consumable fish + processing firms + local market	- live Pangasius	- Quality drivers

Primary activities

a. Inbound logistics, operations and outbound logistics are integrated

The traders usually go directly to fish farming gates to do business. The traders also have a force of local brokers who will show them the harvest of fish farmers and they will get a commission fee from the traders. The fish brokers usually go to a fish farmers' gate to ask about the harvest, so they know a lot about the harvest and they may get a bonus from the traders.

In case of the traders are the companies' staffs, after the traders discuss business with the fish farmers, they will take a processors' technician from the buying division to the farm gate to check the quality of the fish and look for Malachite Green and chlogramphenicol. After purchasing the Pangasius from the fish farmers, the traders will classify the Pangasius in term of quality, colour, size and weight. Poor quality fish that cannot be exported, will be sold to the domestic markets through retailers.

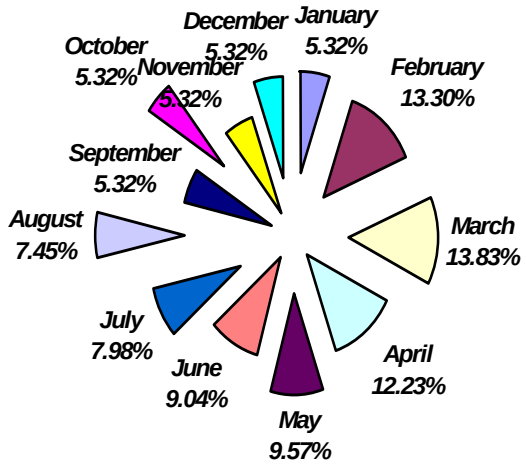
Most of the traders use a special boat[2] (called a "ghe duc") with a huge capacity and facilities to keep the fish alive. The average capacity of the boat is 20 to 40 tonne of live Pangasius.

The traders do not store live fish products for business, but they sell immediately after purchasing, because they do not want to run any risk such as the cost of breeding, epidemic disease, fluctuation of prices or an unstable foreign market leading to a drop in fish prices. Fish traders pay a lot of attention to transporting fish products to the processing companies: they always try to do this on the same day, because the longer the transport takes, the more weight the fish will lose.

b. Marketing and sales

The traders do business throughout the year. But according to the survey of Son (2003), the most popular months in which the traders usually buy the most are February (13.30%), March (13.83%) and April (12.23%) as shown in figure 2.

Figure 2: Purchasing percent of Pangasius trading in around year



Source: Son et al., 2003.

Fish traders obtain their information on fish supply in two main ways: (i) by investigating the market themselves, and (ii) by getting secondhand information from other traders. In fact, fish prices will be set by negotiation between

farmers and traders. The price of fish at the market is determined by natural market forces and not by a specific group of traders and collectors. The price is usually determined by factors such as demand, supply, quality and the size of the fish. Traders usually purchase live fish by means of “package”: the purchased amount includes bad quality fish or fish that weighs too little to process. This leads to a decrease in the average selling price of the fish which they sell to the export company after classifying them. In addition, the traders usually purchase a small quantity, so the marketing cost per unit of the fish material product becomes higher. Therefore, the traders usually set a lower purchasing price than the export companies.

Traders have gained access to lucrative markets by networks that are based on trust and that provide information on prices, the financial stability of buyers and give access to credit. Information is provided in many ways: from personal conversations to the use of telephones, fax machines and the Internet. The large-scale traders use the Internet to check world market prices and as a tool to double-check the prices of raw materials offered by the processing companies. Flexible access to capital and credit is very important as the need differs according to the seasons.

The private companies have started to build long-term relations by buying raw materials from brokers with some price guarantees, often 5% higher than the market price. This is done to secure a steady supply, plus it is an attempt to make it possible for brokers to upgrade their handling of the fish.

The most common means of advertising for the traders is the printing of calendars for the occasion of the New Year (own survey, 2005)

c. Services

The traders act as distributing agents supplying fish to other market agents, such as fish processors, retailers and other wholesalers. Besides, traders also provide other services to fish farmers. Traders serve as an extension of the sales force. They provide forms of assistance such as paying for the transportation cost of the fish between markets, minimizing the fish farmers’ risk in marketing the fish, providing working capital to other agents and they provide market information.

Support activities

a. Procurement

The traders want to do good business and they need at least some facilities like a boat, trucks, cold storage and freezing storage. In order to communicate better, they should invest more than other groups. The investments that are necessary for business expansion include the purchase of insulated trucks, cash and in-kind advances to fish farmers, the construction of fish processing facilities, the purchase of vehicles, the purchase of communication equipment such as mobile phones, the construction of fish stalls and sales outlets, the procurement of more raw materials, an increase of trading activities, purchase of baskets and containers, etc.

b. Technology development

In the past, the traders were based on the experiences to evaluate the quality of fish by looking at the colour and length/size of the Pangasius, thus they can get risks due to bad quality of fish that they cannot recognize. Nowadays, the traders also take fish samples for quality checking and they pay money for the tests before they purchase the fish.

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[2] “Ghe duc” means a boat where water can flow in and out.

c. Human resource management

The traders in the An Giang and Dong Thap provinces are linked not only with local companies but also with companies in Cantho and HCMC. The traders usually form small groups of five to ten persons to obtain information on prices, the financial stability of buyers and to gain access to credit.

d. Firm infrastructure

Most of the traders want to increase their working capital to increase their turnover. Fish traders assume that informal sources of credit such as moneylenders, friends and relatives with higher interest rates are more accessible than financial institutions and other organizations. A trader needs huge amounts of capital. Credit is provided among traders and between traders and seafood processing companies. Fish traders usually use oral contracts with fish farmers. The processing firms sign a contract directly with the fish farmers throughout the fish traders of the processing company.

Discussion of the performance objectives of trading

Before discussing the performance objectives of trading, we summary it in a “house of quality” model.

House of quality model of trading activities

	HOWs	
	Cost drivers	Quality drivers
WHATs		
Buying	X	X
Transporting	X	X
Selling		X

-Cost drivers: During the business process the traders usually use their own boat or rent ships for transportation. It is estimated that the transportation costs are around VND 550,000 for a distance of 50 km. The people who load the fish have to guarantee the quantity until the Pangasius is weighed at the processing companies or wholesalers. In short, traders get a high gross margin at VND 242,000 per ton. The table below shows the marketing costs and the gross margin for Pangasius traders.

Marketing costs and gross margin for traders

Unit: VND 1,000/ton

Items	**Cost**	**%**
Transportation in selling process	550.00	51.98
Loss in trading process	84.60	7.99
Unloading	79.30	7.49
Harvesting	74.00	6.99
Classifying, packaging	63.50	6.00
Transportation in buying process	60.30	5.69
Taxation	42.30	3.99
Depreciation (net, pump, barrel)	37.00	3.49
Commission to agents	21.20	2.00
Others	45.50	4.30
Total marketing cost	**1,058**	**100**
Buying price	10,363	
Selling price	12,000	
Marketing margin	**1,637**	
Gross margin	**579**	

Source: NPT survey, 2005.

-Quality drivers: In buying activities, most traders are concerned with the quality of the Pangasius. They understand that the market is very choosy. According to Mr. Hai, a trader in the Chau Phu province, to sell Pangasius he must obtain a certificate that guarantees the quality required by the processing factories. In currently, the traders usually take the fish samples to a quality center for quality checking and they pay money for this before they purchase the fish. This leads to the quality gurantee of the purchased fish.

Another problem concerning the fish quality occurs during the storage and the transport.

The Pangasius traders prefer to deliver fish on time. Consider the relationship between a fish trader and its major customer, and the fish processing factories. If the fish arrives too late, the processing facility may be forced to shut down. On the other hand, fish that arrives too early may go bad before it can be processed.

-Successful factors: The most important factors for the success of Pangasius traders are a good business relationship and trust. Most interviewed fish traders are eager to maintain a long-term relationship with their business partners like fish farmers and processing/export companies. The exchange of market information is considered important in business relationships and the next issue is storage and transport. The responses to the question “What are the main problems you have in doing business**”** show that the first problem is the unstable market price: it is difficult for the traders to reach a good agreement with fish farmers whom traders can give a buying price several days or weeks in advance. This can lead to a problem for the next transaction.

The second problem is that there are much more traders/collectors joining this business and that the competition is fierce. This can lead to a decrease in the marketing margins of traders.

The third problem is related to the poor infrastructure. There were many petrol stations along the way moving fish from farm gates to processing/export companies, that it affects quality and quantity of live fish.

And the fourth problem that is still an issue for some local traders is the fact that the traders check the quality of fish by looking at colour and weight, which sometimes does not exactly lead to a loss in quality of fish.(own survey, 2005).

In short, the quality of live fish is the most important factor for traders. They need to get good quality fish to sell to processing companies and they need to have a good relationship with fish farmers to get good quality fish in term of colour, size and weight.

4.4 The Results of the Interview with the Pangasius Processing/Export Firms

Introduction

The aim of this part is to provide a general overview of the processing/export firms that are part of the Pangasius value chain. In 2005, there were 27 processing companies in the MRD. Most processing companies concentrated on producing exported and processed Pangasius products. Their main activities also concerned raising fish in floating cages, fish paste, frozen fish, cut squids, seafood mix, etc. In general, most of these companies have at least 1,000 employees, of which on average 75% is female; the average capacity of a firm can be around 40- 50 tonne of fresh fish per day (VASEP, 2005).

Most companies exported 90-95% of their products to foreign markets, and only 5-10% is delivered to local markets by agencies, supermarkets and food shops. The processors ship most of their Tra and Basa fillets abroad. In An Giang, the center of the Tra and Basa farming, are the largest exporters located. These include An Giang Joint-Stock Fisheries Export-Import Company (Agifish), An Giang Food and Agricultural Product Export-Import Company (Afiex) and Nam Viet Ltd. (Navico). Large processors in other provinces include Vinh Hoan (in Dong Thap), Cataco (in Can Tho) and Thuan Hung (in Can Tho). These firms together account for 95% of the export of frozen fish fillets (table 3*)*.

Seven processing/export companies have been surveyed, including private, state-owned and joint stock companies. Information on Pangasius processing as well as the management of quality issues was also collected in order to describe how the fish processing/export companies work. Major economic indicators such as the costs and profits were also taken.

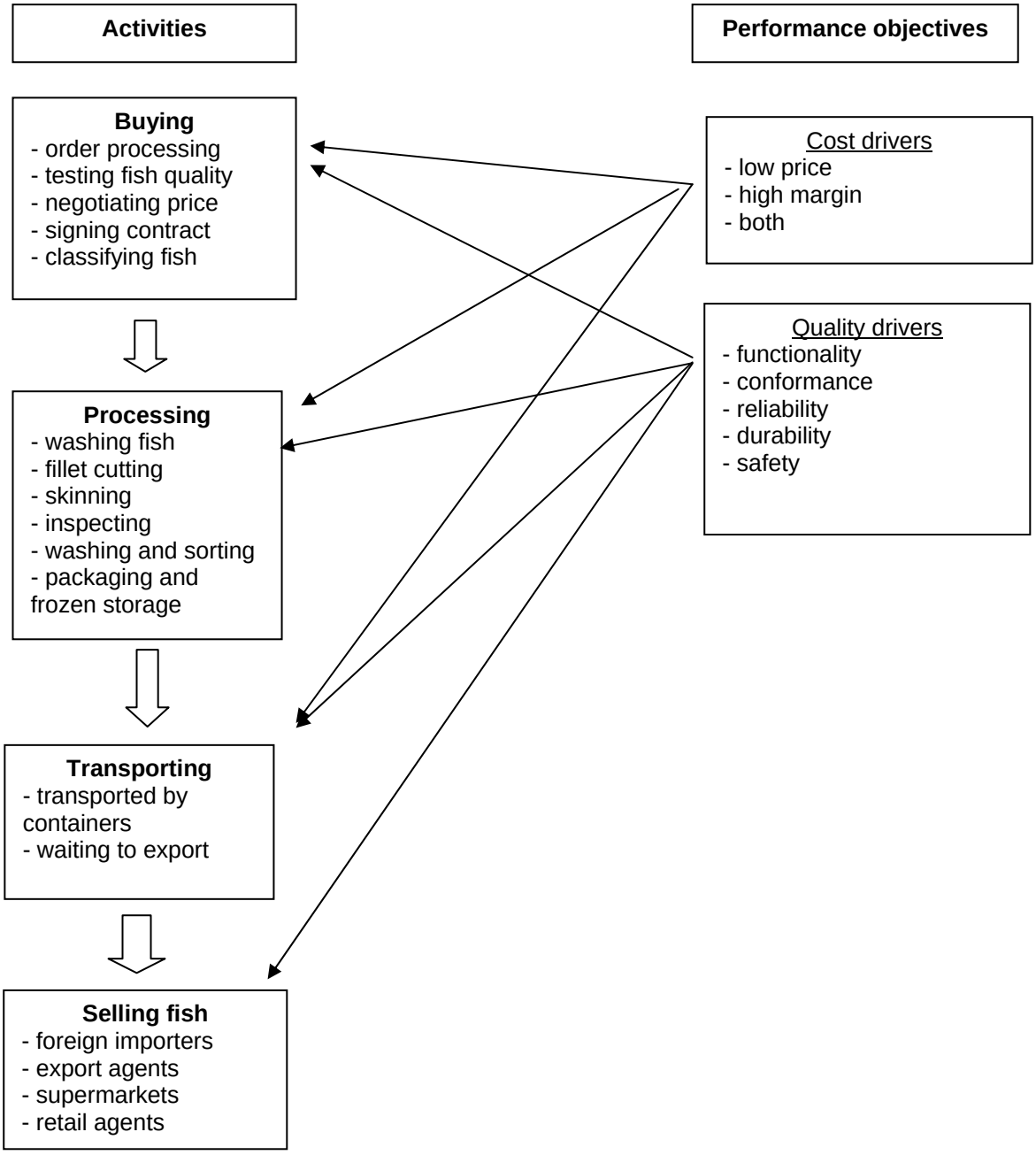
Table 3: Market share of Vietnam's frozen fish fillet exporters in 2005

Exporters	***Share (%)***
Navico (Ltd.)	40
Agifish (joint-stock)	15
Afiex (state-owned)	10
Cataco (state-owned)	10
Thuan Hung (Ltd.)	9
Vinh Hoan (Ltd.) 11	6
Others	5

Source: VASEP, 2005

The figure below shows the activities in processing/export firms and the performance objectives that affect the activities.

The activities of Pangasius processing in processing/export companies will be described as follows:



Main activities and resources that are used in processing/exporting

Main primary activities	Main resources	Performance objects
- Buying + order processing + testing quality + price negotiation + signing contract + classifying fish	- Capital - Credit	- Cost drivers - Quality drivers
- Processing + washing fish + fillet cutting + skinning + inspecting + washing and sorting + packaging and frozen storage	- IQF freezers - air tune freezers - contact freezers - ice machine - fillet graders - metal detectors	- Cost drivers - Quality drivers
- Transporting + transported by containers + waiting to export	- boat - truck - containers	- Cost drivers - Quality drivers
- Selling fish + order processing + pricing + promotion + channel selection	- Pangasius products	- Quality drivers

Primary activities

a. Inbound logistics

The processing/export company buys fish raw materials directly from the farmers' fish floating cages and ponds, and from traders. The main flow of fish raw materials is via traders who work for a company. Besides, processing companies tend to culture their own fish for their processing activities. This helps processors to become less dependent on external suppliers. All raw materials are inspected upon arrival and must be approved by the Quality Inspection Team before being allowed into the processing areas.

b. Operations

Live fish are the most important material used in the processing of frozen Tra and Basa fillets. 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, which helps the processors to recover some of the costs. On average, fillets account for 30-40% of the weight of a whole fish. More specifically, 3.2 kilograms of live Tra or 3.9 kilograms of Basa are required to produce one kilogram of fillets. Frozen products represent the most common form produced by processors, followed by dried products and fish sauce or paste. Besides, high value added products like filleting, ready-made, or surimi are also produced by various processors.

c. Outbound logistics are integrated with marketing and sales

Fish processing plants are also located in the MRD near the fish villages. This makes it easier for processing companies to purchase Pangasius from fish farmers. The processing/export companies also have agents to collect fish. Since processing companies require larger volumes of fish, they tend to link up with more powerful brokers and larger farmers to secure volume and profit in the increasingly capital intensive production under the HACCP and the EU code requirements.

The processing/export companies sell the seafood products to traditional and new importers. Traditional importers get their orders through fax or telephone in order to save time and money. The companies know potential importers via international trade fairs. Almost all processing/export companies recognized that participating at fish trade fairs is the best way to make contact with future business partners.

Trade fairs for fish and fishery products are organized in many European Union countries. The most relevant fair for exporters of fishery products is the European Seafood Exposition together with Seafood Processing Europe, held once a year in Brussels, Belgium.

To set the buying price, all export enterprises usually use the import market price. From the selling price, they also have to deduct other costs such as utilities, worker wages, loan interest, value added tax and the wastes, etc. and at least 20% of profits; then reversibly calculate the price level while purchasing from the farmers.

The survey shows some ways of marketing for Vietnamese seafood companies to EU market.

* Direct mail: The seafood company can write a letter (post, fax or e-mail) directly to a European company. Most companies will respond that they are not interested or that they already carry a competitive line – or they may not respond at all. An importer of fishery products receives many business proposals through e-mail. However, only a few positive replies are needed to continue one's search and evaluation of prospective distributors. Add a product and price list to your mail. In this way importers know directly what you can offer.

* Indirectly through an Internet site of the company: A simple Internet site with the products, vision and address of the company suffices. The company can also make use of the export directories where it can register or publish company information (for example www.fish.com or www.sea-ex.com).

* Personal visits: Once the company has received a number of interesting replies, they may plan a trip to that market. Additionally, while travelling they may stop in other potential markets to assess the situation as well as attempt to make contacts. Often a personal visit will be profitable

* Invite EU importers or potential business partners to visit the processing factory: Due to the strict quality terms, it is more common for an importer to visit a processing factory and vice versa.

* Build a network in order to extend the contacts.

* Visit international trade fairs: This is an efficient way to find customers and to advertise one's fish products.

* Set a price: To establish an overseas price, export companies consider the same factors that are involved in pricing for the domestic market. These factors include competition; costs such as production, packaging, transportation and handling, promotion and selling expenses; and most importantly the demand for a product and the maximum price the market is willing to pay.

*****Terms of payment: Vietnamese exporters may prefer a letter of credit (L/C).

*Terms of sale**:** Vietnamese seafood exporters follow the international commercial terms (INCOTERMs) to set the international trade rules. Now, almost all export companies use FOB terms for export. FOB (Free on Board): under this term the seller quotes a price for goods that includes the cost of loading at the port of departure. The buyer bears the cost of sea transport and insurance.

***** Sales promotion: One of the critical success factors for exporters of fishery products to the European Union is the attention to customer requirements and the ability to maintain a good relationship with the European business

partners. Sales promotion revolves around developing and expanding these customer relations and thus maintaining and increasing sales.

Throughout the survey of 94 seafood companies conducted by Dr. Thu 2003 for the type of marketing of Vietnamese seafood exporters, table 5 will show the frequency of application.

Table 5: Type of marketing of Vietnamese seafood exporters

Type of marketing	Number of SFCs	Frequency (%)
1. Visit international trade fairs	83	88.30
2. Indirect through an Internet site of the company	35	37.23
3. Personal visits	11	11.70
4. Direct mail	85	90.43
5. Invite importers to visit the processing factory	42	44.68
6. Companies' catalogue	53	56.38
7. Other	42	44.68

Source: Thu et al., 2003.

d. Services

The processing companies tend to build their factory near the fish material areas. The processing companies supply credit (about 40%) to fish farmers who have a good relationship with companies to get a stable source of good quality materials. Some processing companies also have support programs for the fishermen about breeding ways in order to eliminate the usage of the inimical chemicals and to prioritize the production of clean products. In order to guarantee these things, the company combines the application of modern equipment to discover the redundancy of antibiotics with the training programs.

In the MRD, some companies in provinces like An Giang, Can Tho and Dong Thap set up fishery clubs. The clubs supply inputs to clubs' members such as rice offal, fish powder, soy-bean for feeding fish and aquatic veterinary drugs to prevent and treat diseases for fish. Moreover, some companies in the An Giang province such as Agifish and Afiex are operating a technical service enterprise that specializes in designing and installing fisheries industry equipment for freezing factories.

Support activities

a. Procurement and technology development

The processing factories are equipped with advanced equipment and modern processing chains. In order to improve product quality and to diversify products lines, almost all big processing/export companies in the MRD have invested in modern machinery. These companies bought the latest equipment from developed countries such as Japan, America and Germany in order to meet the higher demands of the customers. About 50-70% of their total investments has been made in processing technology (Mr. Buu Huy, Deputy Director of Afiex company).

In the case of Agifish, for example, the company purchased individual quick freezing (IQF) 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.

Moreover, the processing companies have applied the quality management systems of HACCP, ISO 9001:2000 and SQF 2000 to guarantee the best quality for the products and to meet more and stricter market demands. Most

processing companies get the EU code that makes it easier for them to export to EU where there are very strict rules concerning quality.

b. Human resource management

Most processing companies in the MRD have at least 1,000 employees which average female counted 70-75% (Agifish company). The employees in the processing companies are encouraged to attend training and courses on quality management and specific work skills that serve the production and business activities of the company, free of charge. However, only a small percentage of them were trained on how to use quality management tools, because the companies only focus on the managers of each process. Staff assigned to checking product quality are on duty at every phase of the process to ensure the quality.

c. Firm infrastructure

It depends on the current situation and the demand of importers and the international market what the export companies plan for export. Now, most export companies face with the strict hygiene rules in the EU market, a potential market for Vietnamese Pangasius, so almost all export companies plan to establish a trace system which tells you exactly which factory, which production unit and which material supplier is the source of a product. In order to get the stable raw materials of fish, the export company will maintain a contract farming with fish farmers.

Discussion of performance objectives of processing/exporting firms

Before discussing the performance objectives of processing/exporting fish, we will summarize it in a "house of quality" model.

House of quality model of processing/exporting activities

	HOWs	
	Cost drivers	Quality drivers
WHATs		
Buying	X	X
Processing	X	X
Transporting	X	X
Selling		X

-Cost drivers : Live fish is the most important material used in processing frozen Pangasius fillets. On average, fillets account for 30-40% of the weight of a whole fish. More specifically, 3.2 kilograms of live Tra or 3.9 kilograms of live Basa is required to produce one kilogram of fillets. In addition to the cost of live fish (which accounts for 82% of the net price of fillets), the processors incur costs of labour for fillet cutting, electricity for ice, freezing machines and storage, water, chemicals and packing materials. The table below shows the cost structure of the fillet production process at Agifish.

Fillet production cost structure

	Value (đ)	Share in net price
Net price per kg of fillets (at factory gate, excluding selling costs)	43,000	
Cost of live tra (VND per kg of live fish)	12,000	
Processing ratio (weight of live fish per kg of fillets)	3.2	
Cost of live tra (VND per kg of fillets) (3.2 * đ12.000)	38,400	
Waste recovery (skin, viscera, bone, head, fat) (VND per kg of fillets)	3,200	
Cost structure (VND per kg of fillets)		
Net cost of live tra (38,400 – 3,200)	35,200	81.86%
Labor	3,397	7.90%
Electricity, water, chemicals, and packing materials	594	1.38%
Rent	63	0.15%
Depreciation	365	0.85%
Interests	453	1.05%
Tax	1,088	2.53%
Profits	1,840	4.28%

Source: Agifish company, 2002.

-Quality drivers: In order to get the guaranted quality, all processing enterprises have monitoring processes for a complete quality examination of the Pangasius. Enterprises have to implement the standard prescribed by Vietnam's fishery industry. Most processing factories applied the quality management systems of HACCP, ISO 9001:2000 and SQF 2000 to the production process to guarantee the best quality for the products in order to meet the more and stricter market demands. Besides, processing factories were equipped with the advanced equipments and the modern processing chains to meet the more and more higher demands of the customers. Moreover, the processing firms frequently organize training courses to enhance the workers' skills. Workers' hygiene at the production site is generally maintained at a very high level. For instance, clothes, hands and legs are desinfected at the entrance.

The processing/export companies also try to establish and maintain long-term relationships with their business partners. Investment in the relationship between exporters and importers may increase trust between the two parties. The usual way to get orders is for the exporters and importers to meet at a fish trade fair. Next, the importers will pay a visit to the export firm and collect relevant information concerning the capacity of the firm and its production process. Then, they may enter into a contract for the supply of certain containers; depending on the demand, the contract will be renewed and their business relation will be maintained.

-Successful factors : Vietnam's exporters often have close relationships with importing partners in the US, EU and Australia. Normally, the two parties visit each other, exchange information on the origin of inputs, processing technology, quantity and price, and they check quality standards like HACCP, ISO 9001:2000 and SQF 2000. In addition, a visit to an international trade fair is an efficient way to find customers and advertise Pangasius products.

The responses to the question "What critical problems did you have encounter in business operations" show that safety and quality standard requirements from difficult markets such as the EU, US, and Japan are the most important problem. Importing countries have strict rules regarding fish imports from developing countries. The fish exporters from the developing countries have to adapt to the new and more stringent rules concerning safety and quality standards which could have considerable impact on the volume of products exported.

Besides, there is a lack of quality knowledge about HACCP, SQF and ISO on the middle managers' and workers' level, as well as a lack of methods and principles for applying HACCP quality control standards, a lack of capital to

invest in modern technique and testing equipment which results in hazardous infections of final fish products. As a result, Pangasius products have not met customer requirements and expectations on product quality.

The second problem is not tight management of government that leads to imperfect competition among the export companies. For instance in 2005, a few big fish exporters reduced the price of Pangasius products, so that others had to lower their prices too at a fishery fair that was organized in Belgium. This led to the failure of Vietnamese Pangasius brand name with foreign partners (VASEP News, 2005).

A lack of contract farming between the fish farmers and the processing companies is the next problem. There is no formal organization and there are often complaints and disputes among processors and farmers. Currently, farmers have been accused of breaking contracts when higher prices were offered. Besides, when the processing companies are faced with a surplus of fish products from contracted producers, quality standards are sometimes tightened up (e.g. with respect to colour, size and weight), so processors can reject unwanted output.

Another problem is that fishery in the region is primarily organized by locals. Therefore, no one can estimate the actual output from each province that leads to too much supply.

Generally, the main problem for processing/export companies is that their products are barred by barriers of seafood safety and hygiene regulations in import markets, such as the EU, US and Japan. To overcome this problem, cooperation among the fish farmers, processing/export companies, institutions and service providers is encouraged. However, this cooperation has not been implemented very well because of the lack of official regulations.

4.5 The Results of the Interview with the Pangasius Retailers

This survey provides a general description of the Pangasius retailers in Vietnam, because it aims to focus on the export market.

The retailer is the market operator who is active at the last stage of the marketing channel of selling to consumers. The effectiveness of the retail network ensures that the consumers' demand for fisheries products is satisfied. Retailers form a nation-wide retailing network and generate income for the market operators, supply different forms of fish products and contribute to market stabilization.

Fish retailing is carried out throughout the country, in cities, urban and rural areas, and both inside and outside market places. In my survey, all of the retailers are operating at local or regional markets and supplying fish mostly to the local community.

Fish retailing can be organized differently in various types like supermarkets, market stalls or itinerant retailers. The survey showed that most of the retailers had a stable market place to operate in; the most popular one is the market stall. And there were still the retailers operating as itinerant ones.

In order to meet consumers' demands, various forms of fish products are delivered including fresh, frozen, dried, canned, sauce, etc. But the survey showed that only retailers working in market stalls can supply various forms of fish products, while itinerant traders mostly focus on fresh products. Dried fish, fish sauce or fish paste are the main products supplied by supermarkets. Among the different types of retailers, only supermarkets regularly stock fish products while itinerant retailers and market stall owners often do not. This can be due to the fact that the products in supermarkets are less perishable. It is necessary to enhance the storage capacity of retailers to increase their ability to stabilize fish supply and to reduce changes in prices and quality.

4.6 The Role of Supporting Institutions

This part will describe the role of supporting institutions and other associations that are related to the primary actors in the Pangasius supply chain.

a. Ministry of Fisheries (MOFI)

After the war against France to recover and develop the local economy the government paid much attention to fishery development. The Fishery Department under the MOAF was established as the first state administration agency on fishery in 1954.

After restructuring in April 1960, the MOAF was divided into four new organizations, namely the Ministry of Agriculture, the Ministry of State-Managed Farm, the General Department of Forestry and the General Department of Fishery (GDF). On 5 October 1961, the Government promulgated the Decree 150/CP which defined the mission, competence and organizational system of the GDF. It was a milestone marking the moment that the fishery sector was recognized as an important part of the national economy.

After the reunification of the country in 1975, Vietnam's fisheries developed even more. The development was marked by the establishment of the Ministry of Marine Fisheries in 1976, renamed as the Ministry of Fisheries (MOFI) in 1981. With the new name the Ministry undertook two additional missions, namely the freshwater aquaculture and the import/export of fish products.

MOFI now consists of nine departments and four research institutes, namely the Fisheries Department, the Fisheries Resources Conservation Department, the Department of Planning & Investment, the Department of Personnel & Labour, the Department of Science & Technology, the Legislation Department, the Department of Finance & Accounting, the International Cooperation Department, the Ministry's Administrative Office, the Department of Inspection, and the Aquaculture Research Institutes Numbers 1, 2 and 3, and the Research Institute for Marine Products.

The Fisheries Resources Conservation Department and a system of 37 sub-departments in localities are 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 and a system 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 being given to the implementation of the Law on Fishery, which was approved by the National Assembly in 2004.

In the organization system, there are also scientific institutions and media agencies. Socio-political organizations and professional societies play an important role in organizing and encouraging fisheries labourers and enterprises to develop their business and production, as well as participate in the sector administration. They are the Vietnam Association of Seafood Exporters and Producers (VASEP), the Vietnam Fisheries Society (VINAFISH) and the National Fisheries Quality Assurance and Veterinary Directorate (NAFIQAVED).

b. The Vietnam Association of Seafood Exporters and Producers (VASEP)

VASEP is a non-governmental organization, founded on June 12th 1998, based on the principles of volunteerism, autonomy and equality. VASEP's members include leading Vietnamese seafood producers and exporters and companies that service the seafood sector. At 2003, VASEP has 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 essential market information; watches trends and develops national strategies for the seafood industry so that each enterprise can better determine its orientation for development; organizes and implements trade-promotion activities and on-the-job and

short-term trainings; and supports the business expansion of the member enterprises.

VASEP also assists its members in seeking financial and technical assistance from various sources to upgrade the quality standards and add value to their seafood products. This enables members to make their products more competitive in the world market.

With its good and growing reputation in both the domestic and the international markets, VASEP represents and protects its members' legitimate rights and interests in regards to governmental authorities and third-party bodies.

c. The Vietnam Fisheries Association (VINAFA)

Along with the establishment and development of the state administration, civil society organizations of people working for the fisheries sector have been established and play an important part in the sector development, mobilizing all kinds of human and financial resources for fisheries development in Vietnam. The Vietnam Fisheries Association (VINAFA) was established in 1982, the Association of Shrimp Culture (the former Vietnam Association of Aquaculture) in 1989, the Trade Union of Vietnam's Fisheries in 1992 and the Humanity Fund of Vietnam's Fisheries in 1996. On 5 May 2000 the Ministry of Home Affairs (MOHA) issued Decision number 33/2000 to assemble the Association of Aquaculture and the Association of Fisheries and formally establish the Vietnam Fisheries Association (VINAFIS). There is a plan to also include VASEP in VINAFIS in the near future.

d. Export and Quality Control Organization (NAFIQAVED)

The National Fisheries Inspection and Quality Assurance Centre (NAFIQACEN) consisted of a Head Office and six branches located in key fisheries locations in the country. It is the national competent authority for fisheries food safety assurance and quality control. On 23 August 2003, the Minister of Fisheries expanded the scope of the work of the centre to include veterinary matters (fish and shrimp disease control) and renamed the centre as National Fisheries Quality Assurance and Veterinary Directorate (NAFIQAVED). Recently, some problems related to the quality of Vietnamese seafood products are rejected by export market like the EU, the US and Japan. The reasons included the level of antibiotics, microbiology and other contaminants. Although the seafood products are checked by NAFIQAVED already, NAFIQAVED just checks random samples not in population, so it is easy to miss something. Besides, the lack of modern tools for checking does not comply with the high requirements of the EU, which leads to seafood products that do not meet the standards for export in terms of safety, hygiene and quality.

e. Financial institutions including 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 and the Bank for the Poor (Policy Bank). In addition, provincial authories and government bodies invest directly in state-owned fishery and fish processing enterprises. The Policy Bank provides loans to fish farmers on a very limited scale, not to processing factories. Moreover, there are some donors (UNDP, DANIDA) and the NGO that sponsors projects and provides credit to fish farmers in some provinces of Vietnam.

Informal sources of credit such as moneylenders, fish wholesalers and processors, and suppliers of inputs seem to play a certain role in providing loans for both working capital needs and to a lesser extend capital investment.

The banks play an important role in providing loans on the basis of mortgage (properties or agricultural land). However, the capital is limited while the people’s needs for loan is 1.5 to 2 times higher than the actual loan. Loan repayment and loan use have not been satisfactory under most institutional credit programs.

f. The Provincial People’s Committee (PPC) and various departments of the PPC are responsible for the management of the different sectors in the province to promote economic development. The PPC provides

guidelines for fish farming, designation of areas, estimation of productivity as well as the capacity of the factories to encourage households to raise fish within their suitable capacity. The PPC includes representatives of the fish farmers and acts as the bridge between the fish farmers and the processing factories and helps them in terms of productivity, needs of the market, and negotiates with banks to increase loans for the members.

g. Farmers' organization

After the collapse of agricultural cooperatives at the end of the 1980's and the beginning of the 1990's, the spontaneous and rapid development of seafood caused a number of problems that were associated with the lack of planning. The importance of cooperation among producers in agriculture, forestry and fisheries has been gradually recognized after many crop losses. The farmers then were grouped together. Recently, the operation of large aquaculture farms under the shared group scheme has been considered and gradually developed, especially in places where producers and investors together buy land for the establishment of shared farms, mainly for intensive Pangasius farming. Good examples can be observed in the An Giang and Dong Thap provinces in the MRD.

In order to restablish and encourage the cooperation among the producers, the Law of Cooperatives was issued on 20 March 1996. Decree 16/CP dated 21 February 1997 was issued to encourage the agricultural cooperatives. This decree was issued to guide the transition and registration of the cooperatives. Decree 46/CP dated 29 April 1997 was issued to regulate the establishment and operation of cooperative economy for the fishery sector. This was guided in detail by Circular 1/1997 on 15 September 1997. Revised Law of Cooperatives was issued on 26 November 2003 and was in force from 1 July 2004. Most of the cooperations between small farmers now are established in terms of cooperative clubs, together with extension and micro credit groups.

The interviews with some cooperatives in the An Giang province showed that they contribute to the development of their members: providing inputs and services like pond preparation, fingerlings, veterinary drugs, electricity, credit, providing market information, being an intermediary between small farmers and processing firms, buying products directly from farmers, etc.

But currently, the operations of the cooperatives were weak. As a matter of fact, only a few cooperatives bought products from their members and sold them to processing firms or traders, or coordinated trading between those agents. Most of the cooperatives only provided their members with technical training and market information.

Problems for fishery cooperatives (own survey 2005)

- Most of the cooperatives that we interviewed were not "real" cooperatives. The provinces only concentrated on some prominent cooperatives but not on all. Therefore, many of them operated as if they were "self-help" units.
- The management capacity of the management board of the cooperatives was poor. Those farmers with good expertise and experiences did not want to join cooperatives.
- The cooperatives lacked capital for their business and their access to formal credit was limited. Most of the cooperatives had to use land certificates of their members to collateralize for loans, which in many cases was not easy.
- Most members of the fishery cooperatives do not culture fish of the same size, so that selling those different products was difficult.
- Market information was insufficient, making it difficult for cooperatives' members to find a market for their products.

h. Women's union

Women's groups are often created at different levels. At the commune level, most of the women's groups shared activities, especially for micro credit and technical transfer programs for different purposes, including aquaculture, in order to strive for poverty reduction, clean water and others.

i. Aquaculture research and extension systems

Statistical data recently showed that although the number of labourers working in the fisheries is not small (3.6 million), the education level of the labour force in aquaculture is not sufficient for aquaculture development. Of the 668,000 labourers in aquaculture in 2003, 13.8% had not finished elementary school, and 39.6% and 31.6 % had not finished secondary and high schools, respectively. The remaining labourers attended a form of higher education (GSO, 2004). The data for vocational, bachelor and higher levels were 5.5%, 8.1% and 1%, respectively (GSO, 2004). 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 (Agriculture University No. 1); 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 and 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 the farmers in order to help them improve the economic efficiency of their aquaculture farming activities.

j. The production, uses and trends of fish meal and fish oil that are produced by waste usage of Pangasius in the MRD

Fish waste (offal) generated during the fillet production such as the head, tail, skin and viscera is processed into fish meal or fish oil, which helps the processors recover some of the costs. In order to show what can be done with waste, I will briefly describe the production of fish meal and fish oil.

* Fish meal

There are two main ways of producing fish meal:

- The traditional, artisanal way of direct drying which produces "fish powder", used mainly to feed livestock.
- An industrial process in which the raw materials are cooked before being dried. Many fish meal factories use the traditional method in which trash fish is sun-dried before being ground. However, one respondent was of the opinion that it should be banned because of bacterial contamination of the final product.

Most fish meal plants are in the south of Vietnam (MRD), where there is the greatest supply of trash fish.

The quality of Vietnamese fish meal is regarded as low quality with a low protein content (a maximum of 60% for a limited amount of the product) and high histamine and cadaverine concentrations (Edwards et al., 2004).

Fish meal is produced from trash fish, low value fish (sharks), spoiled fish and processing wastes.

Vietnam used at least 60,000 tonne of fish meal in 2003, at least 90% of which was imported (MOFI, 2004). The

rate of use of fish meal is increasing rapidly because of the development of aquaculture. To support the predicted growth of aquaculture, at least 150,000-200,000 tonne of fish meal will be required (MOFI, 2004). One feed mill, Proconco, imports about 10,000 tonne fish meal annually. However, the price of imported fish meal continues to rise.

* Fish oil

At the present time, Vietnam does not produce fish oil in the fish meal production process. Fish oil is imported from South Korea. However, there is a small-scale production of fish oil from Pangasius in the Mekong River Delta, namely Agifish, a joint-stock company in the An Giang province.

Agifish Company has a plant to produce fish oil. Offal is purchased from filleting factories and is cooked at 70 °C. The oil, which floats to the surface, is collected and filtered. It costs VND 3000/litre. It is mainly used in livestock feed and as an edible oil for humans. The composition of Basa fish oil is similar to that of lard, although it has a very low DHA content of 0.23%.

The oil content of tropical fish is low, with the exception of Pangasius, and this restricts the local production of fish oil with high contents of long-chain unsaturated fatty acids such as DHA.

4.7 Feed mills

In 2004, there were 40 feed mills where there was some kind of cooperation between Vietnam and foreign companies, providing more than 500,000 tonne of feed for aquaculture (MOFI, 2004). In order to meet the feed demand of aquaculture farmers, about 400,000 tonne of feed were imported from Thailand, Hong Kong, Taiwan and the USA. By the end of 2003, there were 15 big companies and 20 to 30 small and medium ones participating in the production and trading of feed for aquaculture in Vietnam, with a total capacity of 250,000 tonne of feed for shrimp and 100,000 tonne for fish per year (MOFI, 2004).

To ensure environmental principles, restrict the use of antibiotics in feed and guarantee clean raw fish material for export processing, some feed mills produce organic feed for fish farmers who want to get a high quality of fish.

- Veterinary suppliers: the number of agents who produce and trade veterinary for aquaculture has not been reported. Unofficial data and information show that about 800 types of chemicals/drugs are now used in aquaculture. Inefficient management of the supply of feed, veterinary for aquaculture, as well as the lack of farmers' technical knowledge and understanding on the application of the major inputs lead to a low quality of these important inputs.

Therefore, the management of the quality of aquatic products, especially the products for export, has become essential to both farmers, traders and exporters, and the entire industry should be done from the beginning of the production, that is, from the control of the inputs.

4.8 Service providers

The private sector is now responsible for most services provided in the Vietnamese fish industry. Insurance services for aquatic products are not popular because there are some risks such as fish diseases, bad weather, price fluctuation - and the fish farmers are the ones who run most of these risks.

Environmental pollution is a big problem in the fish industry nowadays. In order to improve the management of the environment relating to aquaculture, the MOFI established in 2003 two centers for environment warning and prevention, and for the treatment of diseases on aquatic species in the central and Southern regions.

Transportation is an essential element in the efficient operation of marketing systems because it enables the timely

shipment of surplusses to areas with a shortage. Various modes of transportation are used to move fingerlings and Pangasius ranging from airlines, boats, ships and trucks to motorcycle and cycles. The type of transportation depends on the cost, geography and timing.

The majority of the Pangasius products are packaged and delivered fresh (ice packed), individually quick frozen (IQF) or chill packed. There are packaging services to supply pack boxes that meet the requirements of the customers. Besides, there are also maintenance services that maintain the equipment for processing fish when they are damaged.

5. Conclusion

The quality of Pangasius is the result of all the activities performed and all the facilities and equipments used during production, harvesting, processing, distribution and export. Fish quality management directly affects the fish yield and quality, as well as the production costs and profit level of fish farming practices. Quality and cost drivers are two performance objectives in the fish industry.

The major problem in the fish sector is a lack of techno-managerial coordination to guarantee quality in the whole chain. There are four major issues behind it (1) new and stricter rules concerning fish quality and the safety of import markets; (2) the lack of fish culture techniques at farm level; (3) the opportunistic behaviour of the chain stakeholders; (4) the lack of HACCP implementation at company level.

Concerning the first problem, it is a challenge for the fish export firms to fulfill the quality criteria of their export markets. The developed countries now use modern technology and equipment to test for the residues of cloramphenical, nutrofuran, fluoroquinoles and other antibiotics in fish products with zero tolerance. Normally, processing companies and fish farmers in the MRD test their products at the branch of NAFIQAVED. This branch is responsible for a monthly field hazard test, a sample hazard test of farmers' products, and a sample hazard test of processing companies' final products. However, it is difficult for the NAFIQAVED branch to test the samples of individual fish farmers at their fields because of time and costs (Loc, 2006). Besides, there is a lack of modern equipment for quality testing that the machines developed nations used, leading to the fact that fish products do not meet the quality standards of strict export markets (own survey, 2006). Moreover, the hazard test requirements of the import markets are always changing. These challenges present the processing/export companies to face urgent need to react to the new substances found by importers (VASEP, 2006).

With respect to the second problem, fish farmers have a limited culture in terms of using veterinary drugs and feeds for fish that cause chemical hazards. The number of agents who produce and trade veterinary for aquaculture as not been reported. Informal data and information show that about 800 types of veterinary drugs are now used in aquaculture but the local authorities cannot monitor all of them in terms of veterinary brands. On the other hand, the fish farmers are either unaware of their responsibility to ensure the quality of fish or they apply culture techniques insufficiently by using forbidden antibiotics (Chinh, 2005). As far as feed is concerned, both home-made and commercial feeds are used for Pangasius. Of the two, home-made feed is more commonly used because it is cheaper. However, the preparation and the use of home-made feed is one source of pollution that has resulted in a worse quality of fish and higher water pollution (Sinh et al, 2006).

Concerning the third problem, there are a lot of opportunities for opportunistic behaviour due to asymmetric information. The traders use banned chemicals and other substances to treat fish materials before selling them to the processing firms (own survey, 2006). Shrimp traders/collectors profit in the same way (Loc, 2006). According to Loc, the traders inject chemical substances, edible seaweed, shrimp meat or nails to increase the size and weight of shrimp (add to shrimp size and weight) before transporting them to the processing companies. Moreover, the

traders sometimes use visual controls to inspect the colour, size and weight of Pangasius. Visual controls are insufficient to detect hazards.

With respect to the veterinary supply, Chinh (2005) reports that there are 115 companies and 394 products in the An Giang province. Most of the current veterinary wholesales/retailers have some experience in animal health but not in aquaculture. Hence, their recommendations to fish farmers are often inappropriate and far from practical in their application (Sinh et al., 2006). Moreover, deception in the use of veterinary brands and the overwhelming use of marketing promotions on the advantages of using veterinary drugs have confused the fish farmers over the issue of fish quality (Sinh and Nga, 2005).

Concerning the fourth problem, the processing firms lack the conditions and methods that are necessary to the monitoring of product quality within their companies. For example, the processing firms lack the information to control quality and their application of HACCP standards for food safety and hygiene by their managers and workers is inadequate (Loc, 2006). According to Loc, the seafood company managers are the only ones who have been trained in standards of quality management such as the HACCP standard. Thus, their untrained workers are unable to apply these methods effectively and efficiently. In addition, the processing firms' lack of capital investment in modern technology and testing equipment means that final fish products are still not completely free from hazard.

In short, an improvement of product quality and a better management need to be considered – not only at the farm level but also at the processing/export companies. A better coordination of activities between stakeholders in the fish supply chain is recommended.

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