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Market access for small-scale farmers in the Global Value chains-- *The case of Pangasius farmers in the MeKong River Delta, Vietnam*

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Abstract

Aqua-cultured fish is one of the dominant export products in Vietnam. The development of this sector is a major source of foreign currency and employment. The success of the sector encourages both local and foreign investment. In Vietnam, the Mekong River Delta (MRD) is the main producer being responsible for over 80% of the total Vietnamese production (Vietnam Association of Fish Exporters and Producers -VASEP, 2004). The freshwater Pangasius is the most commonly cultured edible fish species in this region. Pangasius farming in the Mekong Delta expanded dramatically: from 154,000 tonnes in 2002 to 1.2 million tonnes in 2007. This explosive growth raises various sustainability issues. Margin became low or negative as cost of input increased and market prices decreased. The Vietnamese government has planned the Pangasius farming area of 8,600 hectares with 1.25 million tons of live fish in 2010 and 13,000 hectares with 1.85 million tonnes in 2020.

Increased export market access for high quality food products is an important avenue for diversification of Vietnam's agricultural sector. It is also essential for sustainable rural economic growth and a reduction of poverty (World Bank, 2006 and 2008). This is especially true for the sectors with high degrees of smallholder involvement. Smallholder farmers in developing countries and in particular in Vietnam face a number of technical and managerial constraints that limit their participation in an export-oriented supply chain (Narayanan and Gulati. 2002; Torero and Gulati. 2004; Van der Meer. 2006; Khoi et al. 2008). The international markets demand that exporters of fishery products assure hygiene and safety for consumers. The need for more stringent quality assurance resulted in a shift towards company-owned farms and vertical coordination. However, the involvement of small-holder may be an important policy instrument for poverty reduction as fish production in Vietnam is relatively widespread among smallholders and many of them cater for export markets (Loc, 2006; Sinh and Phuong., 2006). Therefore, the objective of this research is to design an effective export-oriented Pangasius supply chain based on small-scale farming systems. Put differently, this research explores how small-scale farmers can benefit from the emerging opportunities in the Vietnamese fish industry.

Key words: Pangasius, small-scale farmers, quality management, market access.

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1. INTRODUCTION

Aqua-cultured fish is one of the dominant export products in Vietnam. Total aquaculture production in Vietnam covered one million tonnes in 2003 and allegedly will reach over two million tonnes by 2010 (Ministry of Fisheries- MOFI, 2003). The total aquaculture production has increased already to 2.2 million tonnes in the 2009 (MOFI, 2009). The development of this sector is a major source of foreign currency and employment Vietnam has a coastline of more than 3,200 km long with over 3000 islands, a wealth of natural inland water bodies (lakes and rivers) and seasonal flooded grounds. Since 2000, the fisheries sector is an important contributor to the economy of Vietnam and fisheries are identified as a key economic growth sector by the Vietnamese Government (MOFI, 2006). The total area of water-surface is approximately 1.7 million hectares (MOFI, 2006). The Vietnamese government expects a further increase of the aquaculture sector of more than 25% in 2010.

Pangasius was cultured in the Mekong Delta in Vietnam since the 1950s on a small scale. The farmers collected the fish larvae from the Mekong River during the early flood season. The larvae were nursed in small ponds and provided to local farmers. They stock larvae in the integrated farming systems which integrate livestock and fish production; and the fish were produced for local consumption. However, since the 1990s the Pangasius culture developed rapidly because of rising demand in foreign markets and improved production and management techniques like induced reproduction, feed quality, water management and pond design.

Pangasius is grown in the predominantly freshwater central and Northern provinces of An Giang, Dong Thap, Can Tho in the Mekong Delta. In 2005 the economic growth rate for Pangasius aquaculture in the Delta was 24.9% and production reached some 850,000 tonnes in 2006, contributing to the overall growth of 19.5% for Vietnam as a whole. This gave the Mekong Delta the highest overall economic growth rate in the country at 14.4%, 5.4% higher than national figure for 2005 (Loc, 2006). Export of Pangasius fillets doubled in 2006 to reach 286 thousand tonnes representing a 66.5% increase in value to US$1.15 billion (VASEP, 2006 cited in World Bank, 2006). In 2008 it is estimated 650,000 tonnes of fillets were exported at a value of US$1450 million (Dung, 2008). According to MOFI (2005), Pangasius production will reach up to about 1 million tonnes by 2010 and 1.5 million tonnes by 2020. However, Pangasius production has increased already to 1.2 million tonnes in the 2007 (MOFI, 2008). The most remarkable change in the Pangasius sector has been the shift to European markets after the US anti-dumping case in 2002. Exports to Europe were valued at US$ 374 million or 26.51% of the total export value in 2006, having increased 89.4% from 2005. The export value to EU in particular accounted for 20.86% of all exports or US$ 294.3 million, which was slightly lower than Japan (24.83%)and even higher than the US (18.43%) (MARD, 2008). This shift increased the EU share to 17% by 2005, representing a significant change from the traditional seafood export markets of Japan and the US each with a market share of 25%.

However, almost all of the Pangasius processing/export companies in the MRD face challenges in the export markets for different reasons. The most important reason being the impossibility to guarantee quality and safety (Khoi, 2007). The Pangasius products were infected by antibiotics, microbiology and other contaminants. Many Pangasius containers were sent back or destroyed as a result of the strict import quality controls in the EU and the US (VASEP, 2005). There are three major reasons for these quality problems (Khoi et al., 2008): (1) new and more stringent rules concerning fish quality and safety of import markets; (2) lack of adequate production technology at farm level**;** (3) opportunistic behavior of chain stakeholders.

Given above mentioned quality problems, the success of Pangasius export chains is highly dependent on the elimination of the hazards of primary production (Suwanrangsi, 2000). Raw material production is crucial for fish quality as deficient treatment cannot be corrected later. Small farmers play an important role in this part of the production. The key question in this research is how to involve these small farmers in developing adequate quality management through the entire export-oriented supply chain. Inadequate quality management during primary production has caused hazardous infection in raw materials.

2. Literature Review

Food quality management is a key issue in export supply chains. The need for quality management along the agri-food chain has increased due to serious food crises2 that have occurred in the food industry. Due to stringent food safety standards, involving small-scale farmers in global food chains would require strong quality management. Attention is paid to the institutional requirements that enable smallholders to meet the more stringent food

[2] Bovine Sponggiform Encephalopathy (BSE) and classical swine fever (CFS) in 1997, foot and mouth disease (FMD) in 2001, Avian Influenza in Asia since 2005, Salmonella in the US in 2008, and melamine contamination scandal in China in 2008.

safety and quality regulations. This attention also requires a fundamental reorganization of smallholder production systems and business relationships among chain actors to provide opportunities to smallholders and therefore adjust their supply to meet global food quality standards.

Fish quality management is a rather complicated procedure. It involves the complex characteristics of fish and their raw materials, such as variability, restricted shelf life, potential safety hazards, and the large range of chemical, physical and microbial processes. Producing high quality fish products requires a special approach due to the wide range of factors in the food supply chain that can affect quality. Poon et al. (2003) mentioned food quality management embraces the integrated use of technological disciplines as well as the integrated use of managerial sciences. Both the use of technology to understand behavior of living fish materials and the use of managerial sciences to understand human behavior is needed. Hence, both technological aspects (i.e. fish characteristics and technological conditions) and managerial aspects (i.e. human behavior and administrative conditions) should be managed in order to improve fish quality products. We used techno-managerial approach developed by Luing et al. (2002) to apply for research analysis.

*** Techno-managerial approach**

Luning et al. (2002) proposed a techno-managerial approach for food quality management as a way to analyze and solve the complex quality issues. They distinguished between three different approaches, i.e. the managerial, the technological and the techno-managerial approach as illustrated in figure 1.1. The approaches differ in the extent to which they integrate managerial and technological sciences. Technological aspects measure for solving quality issues are, for example, obtaining a better understanding of the chemical mechanisms, the development of more sensitive (e.g. microbial) analyses, or reducing defects by genetic modifications. Managerial aspects measure for human behavior and its working environment that can affect food safety. In contrast, the techno-managerial approach encompasses the integration of both technological and managerial aspects from a systems perspective. The core element of this approach is the contemporary use of technological and managerial theories and models in order to predict food systems behavior, and to generate adequate improvements of the system.

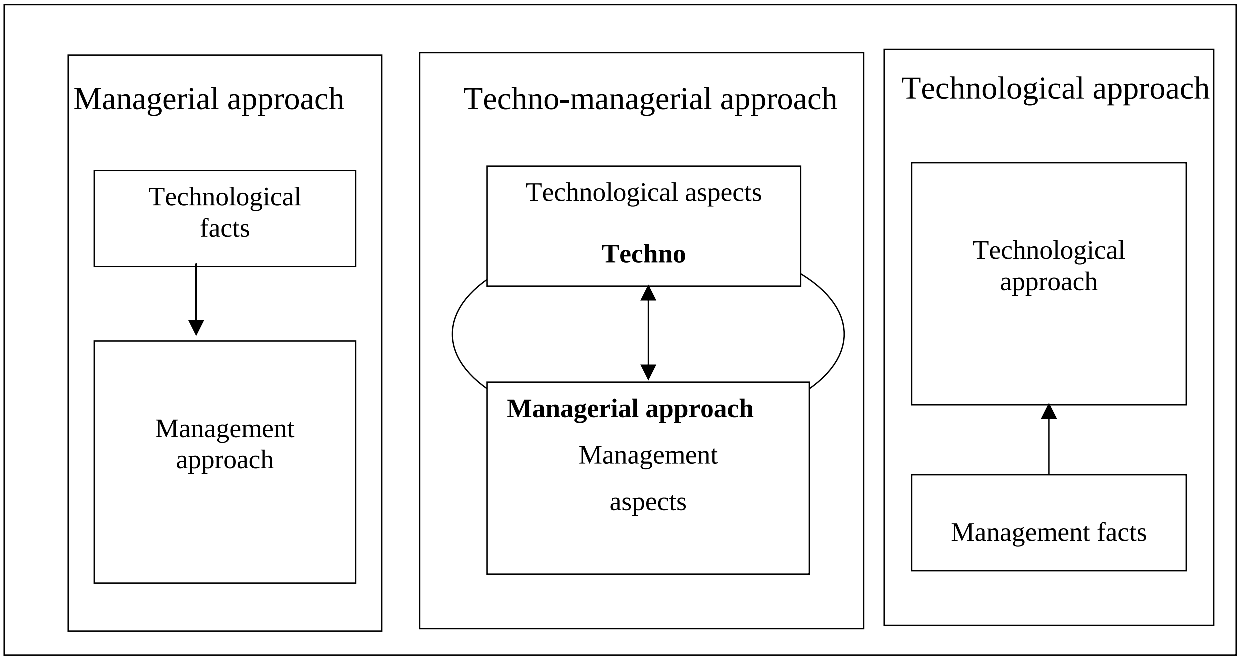


Figure 1 Techno-managerial approach (adapted from Luning et al, 2002).

Technological functions

The quality of food products and raw materials change continuously and can decrease rapidly due to their perish-ability. Food characteristics and process conditions have to be analyzed, to know how these affect physical product properties. Typical measures to reduce effects of variation and perish-ability on food quality are selection of raw materials, processing and preservation techniques, packaging, storage, and distribution. Technological functions are activities, tools, equipment or methods that are necessary to produce goods with certain physical properties.

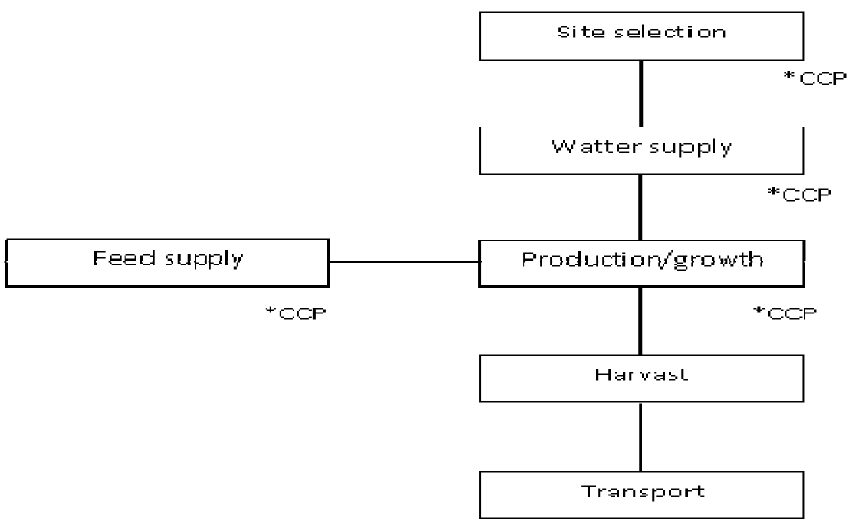
Managerial functions

Quality behavior is dependent on the disposition and ability of employees. Disposition is the employee's own disposition to behave in a certain direction. Factors that influence the disposition are knowledge, standards and information about the results. Ability is the objective opportunity to behave in a certain direction. Factors that influence ability are skills, competence, facilities, and availability of time. Typical measures to manage human aspects of food production quality are providing suitable facilities, training employees, communication, motivational programs and empowerment, and creating commitment. Managerial functions are defined as the necessary decision-making activities to activate the food production system, as well as the management system.

The size of an organization can cause problems for production quality. Many small-scale farms in the Pangasius industry have problems in producing according to quality standards, due to insufficient production technology, financial possibilities, water resources and working conditions (Khoi, 2007). Moreover, the role of local authorities in disseminating the proper production technology is very important.

*** Critical control points (CCPs) in aquaculture production**

The hazard analysis and critical control points (HACCP) system is a management tool for fish safety assurance. While the implementation of HACCP-based safety assurance programs are well advanced in the Pangasius processing sector, the application of such system at the fish farm level is lacking. Reilly & Kaferstein (1997) proposed the critical control points in aquaculture production (Figure 2).



*CCP: Critical control point

Figure 2 Model flow diagrams of CCPs for aquaculture production (Reilly & Kaferstein, 1997)

There are four CCPs associated with the proposed model in figure 1.2, which are steps where control is necessary to prevent or eliminate a fish safety hazard or to reduce it to an acceptable level. These CCPs are site selection or pond location, the water supply, the input (fingerlings, feeds, chemicals) supply, and production or grow-out steps. The nature of CCPs will depend on the aquaculture system and it is essential to consider the unique conditions that exist within each fish farm when developing an HACCP system. The implementation of the HACCP system in fish farms that have adopted good aquacultural practices (GAP), is recommended as a method to improve food safety of aquaculture products (Reilly & Kaferstein, 1997)

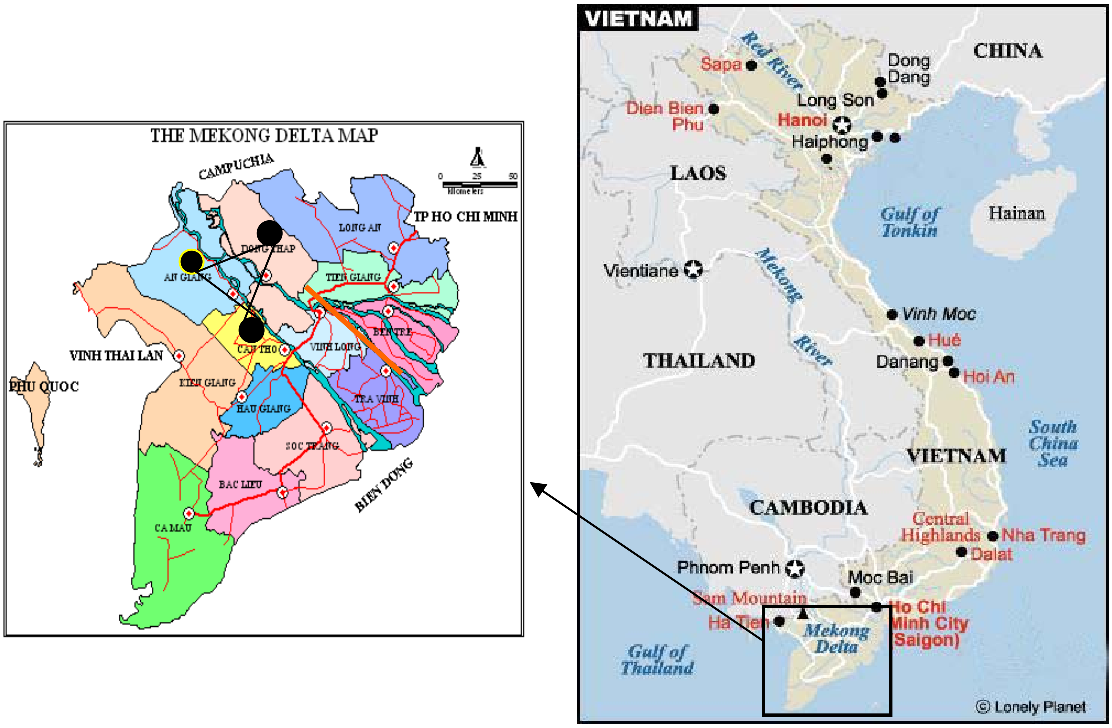
In Vietnam, particularly, some researches in relation to fishery quality chains were conducted. They focused on a growing customer demand for stable and high quality products. Processors make good products and control product quality. But, hazards are still not free from fish products because there are many quality problems occurred at the primary production. Inadequate quality management during primary production has caused hazardous infection in raw materials. Raw material production is crucial for fish quality as deficient treatment cannot be corrected later. Small farmers play an important role in this part of the production. Therefore, the key question in this research is how to involve these small farmers in developing adequate quality management through the entire export-oriented supply chain.

3. Research Methodology

The Mekong River Delta (MRD) is one of seven ecological regions in Vietnam as well as an essential habitat within the Mekong River Basin. The Mekong River Delta (MRD) in the Southern part of Viet Nam covers 12 percent of the total area of the country (see figure 1.3). The MRD comprises approximately 650 000 ha of freshwater bodies, and the freshwater surface may potentially be enlarged to up to 1.7 million ha during the flooding period (Phuong et al. 2007). The freshwater area of MRD has diverse habitats that are suited for various types of freshwater aquaculture. Nevertheless, the freshwater aquaculture plays an increasingly important role in the economic development of the MRD. The production of freshwater aquaculture is about 500 000 tonnes or about 70 percent of the total aquaculture production of the MRD in 2004 (MOFI, 2005).

In Vietnam, the largest production of aquaculture comes from the MRD, varying between 60–70% of total production during the last decade (MOFI, 2006). At the moment, black tiger shrimp and Pangasius are the main aquaculture products in Vietnam due to their high export value in various foreign markets. Their production accounts for approximately 50% of the total production of aquaculture in Vietnam.

Three provinces of the MRD (An Giang, Can Tho and Dong Thap) are chosen for the research implementation where their ecological conditions are different and Pangasius production is popular in terms of culture area, production volume and export value. There are three districts, of which six villages, chosen for the interview. They are Chau Phu from An Giang province; Thot Not from Cantho; Chau Thanh from Dong Thap where have the biggest Pangasius culture area and volume of the provinces in 2009 (Figure 3).



Adapted picture from Lonely Planet

Figure 3 The map of MRD with three different studied

Total sampling size is 123. The details of the sample in each province are described in Table 1

Table 1 Data collection samples

<table>
<tr><th colspan="4">Primary producers</th></tr>
<tr><th>Province</th><th>District</th><th>Completed samples</th><th>Note</th></tr>
<tr><td>1. An Giang</td><td>Chau Phu</td><td>Hatcheries/nurseries/fingerling traders: 3
Feed suppliers: 3
Chemical/veterinary drug suppliers: 3
Farmers: 30
Processing/export firms: 2</td><td rowspan="3">1. Hatchery including spawning itself unit and nursery

2. Farmers are small scale (culture < 1ha) and including traditional farmers and fishery association members</td></tr>
<tr><td>2. Can Tho</td><td>Thot Not</td><td>Hatcheries/nurseries/fingerling traders: 3
Feed suppliers: 3
Chemical/veterinary drug suppliers: 3
Farmers: 30
Processing/export firms: 2</td></tr>
<tr><td>3. Dong Thap</td><td>Chau Thanh</td><td>Hatcheries/nurseries/fingerling traders: 3
Feed suppliers: 3
Chemical/veterinary drug suppliers: 3
Farmers: 30
Processing/export firms: 2</td></tr>
<tr><td colspan="2">Total</td><td>123 samples completed</td><td></td></tr>
</table>

3. RESULTS AND DISCUSSION

We have interviewed 90 fish farmers (45 independent farmers and 45 fishery association members) in 3 provinces: An Giang, Dong Thap, and Cantho. General information of small-scale farmers is presented in Table 2. Youngest farmer is 22 years old, and the oldest is 74 years old. They are mostly male and belong to Kinh ethnic. Their education level varies from university graduation to grade 0, and the average education level is 8 years. Experience in Pangasius culture is considered as an important contribution its performance. Average time involving in Pangasius breeding is 9 years (at least 2 years and at most 33 years). The number of ponds in each farm can from 1 to 3 with an average of 2 ponds corresponding to average areas of 8,010 m^2 per farm (varying from 1000 m^2 to 9,500 m^2)

Table 2 General information of small-scale farmers

	N	Range	Minimum	Maximum	Mean
Age	90	52	22	74	43.34
Education level	90	14	0	14	8.42
Sex	90	1	1	2	1.09
Ethnic	90	1	1	2	1.01
Experiences	90	31	2	33	8.74
Areas of pond	90	8500	1000	9500	8010.73
No of ponds	90	3	1	3	2.3

Source: Survey data, 2010.

- Fingerlings:

Small-scale farmers were aware that the quality of fingerlings is an important factor affecting the production efficiency. They purchased fingerlings from different sources, mostly from private hatchery/nursery in the region (70%); from State –owned hatchery breeding centers (5%); from own nursing (10%), and from fingerling traders (15%) (Table 3).

Table 3 Source of fingerlings

(N=90)	Own nursery	State-owned hatchery	Private hatchery/nursery	Fingerling traders
%	10	5	70	15

Source: Survey data, 2010

Farmers do not have capacity or facilities to check for the quality of fingerlings. They base only on own experience and observation. The most important quality standard, according to the farmers, is that fingerlings should be same size (94.4%); healthy (88.9 %); agility swimming (80.0%), and no banned antibiotics (66.7%) (Table 4)

Table 4 Means to check fingerling quality

N = 90	Same size	Healthy	agility	No banned antibiotics
%	94.4	88.9	80.0	66.7

Source: Survey data, 2010

However, farmers evaluate the high quality of fingerlings from own nursing and State-owned hatcheries (Table 5).

Table 5 Evaluate the quality of fingerling from different sources

(N = 90)	Very high quality	High quality	Medium quality	Low quality	Very low quality
1. Own nursing	44. 4	17.5	27.0	6.3	4.8
2. State - owned hatchery	30.2	45.3	20.8	3.8	-
3. Private hatchery	15.3	36.1	41.7	4.2	2.8
4. Fingerling traders	1.9	7.4	24.1	44.4	22.2

Source: Survey data, 2010

Important factors of fingerlings affecting the quality of Pangasius production were cited by farmers as: source (78.3%) and fingerling quality (94.0%), stocking density (68.3%), fingerling's size (62.3%) (Table 6)

Table 6 Factors related to fingerlings

(N = 90)	Very important	Important	Neutral	Not important	Not important at all
1. Source of fingerlings	50.6	27.7	13.3	6.0	2.4
2. Fingerling quality	68.7	25.3	4.8	-	1.2
3. Stocking density	24.4	43.9	29.3	2.4	-
4. Size of fingerlings	19.3	47.0	28.9	4.8	-
5. Price	10.1	31.6	41.8	15.2	1.3
6. Releasing time	9.9	29.6	40.7	13.6	6.2
7. Local law of buying fingerlings	1.5	9.2	32.3	27.7	29.2

Source: Survey data, 2010

- Feed

Besides fingerlings**,** small-scale farmers were aware that feed for fish is also an important factor affecting the production efficiency. Majority of small-scale farmers use home-made feed (53.5%); industrial feed (22.6%); and both of them (23.9%) in order to get nutrition for fish and save cost (Table 7). According to the survey, most of farmers in study area assessed that industrial feeds are costly than home-made ones. This is understandable as very high percentage of farmers in this area is using home-made feed. Therefore, despite the fact that industrial feed has many advantages such as lower water pollution, whiter of fish, better quality etc…; home- made feed still remains the popular type of Pangasius feeding in traditional locations. For home-made feeds, there is no quality control since it is produced by the farmers themselves. As a consequence the pond gets more polluted. Moreover, home-made feeds consist of many ingredients such as fish meal, soybean meal, corn, dried fish, meat bone meal and poultry; therefore, it is difficult to keep records of all ingredients. In addition, home-made feeds are usually over-feeding which cause pollution from residues. To improve quality of feeds especially home-made feeds; studies on nutritional requirements for Pangasius have been carried out intensively during the last few years at CanthoUniversity and other research institutions. These institutions provide information about feeding formulas for Pangasius production to improve feed utilization reduce waste loads from feeds (expert interview, 2010).

Table 7 Type of feed

(N = 90)		Ratio (%)
Type of feed	Home-made feed	53.5
	Industrial feed	22.6
	Both	23.9
	Total	100.0

Source: Survey data, 2010

Important factors of feed affecting the quality of Pangasius production were cited by farmers as: feed price (92.5%) (Table 8). Local regulations about feed used do not affect in production process (5.7% for (very) important).

Table 8 Factors related to feed

(N = 90)	Very important	Important	Neutral	Not important	Not important at all
1. Feed types and sources	39.2	45.9	12.2	2.7	-
2. Quality of feeds	63.9	33.7	2.4	-	-
3. Quantity and feeding time	14.5	46.1	35.5	3.9	-
4. Feeding formula	32.4	30.9	33.8	1.5	1.5
5. Feeding methods	16.7	37.2	35.9	9.0	1.3
6. Feed prices	53.8	38.7	7.5	-	-
7. Local law of feeds	3.8	1.9	47.2	17.0	30.2

Source: Survey data, 2010

- Water management

According to small-scale farmers, good water management helps improve efficiency of fish production and reduce fish's diseases (Survey, 2010). It also helps reduce water pollution in the environment. The interviewees believe that water's quality (73.2%) and frequent water change (48.1%) are very important to the fish culture in ponds. However, local farmers paid little attention to the regulations on waste water management (40% as very (important)) (Table 12). Therefore, water pollution is a great problem to the farmers and local authorities.

Most of farmers did not pay interest in the advises of local authority to use of waste-water treatment ponds because of its high cost of construction and land area. Sedimentation ponds also take up land area which is an expensive investment. In addition, waste water and sludge are still not managed well at the small-scale farms. For fresh water criteria, it has to stay in the waste-water treatment pond for 10 hours to be decomposed. However, the capacity of sediment pond is often small to treat water effectively to meet water quality criteria before discharging it to environment. The discharge of pond water into the channels and rivers without any waste-water treatment is causing conflict with the surrounding water users like (paddy) farmers and households.

Although there are regulations about water treatment by constructing waste-water treatment pond or paying for environmental amelioration, most of farmers do not follow because of the unequal taxes among different farmers and opaque taxation.

Table 9 Factors related to water management

(N = 90)	Very important	Important	Neutral	Not important	Not important at all
1. Water's quality	73.2	22.0	3.7	1.2	-
2. Frequent water change	48.1	43.2	8.6	-	-
3. Water treatment (DO, pH, NH_3)	34.6	41.0	21.8	2.6	-
4. Local regulations of waste water	18.5	21.5	33.8	10.8	15.4

Source: Survey data, 2010.

- Fish disease treatment

Most of the farmers trust in their own experience in treating fish's diseases (76%), or follow laboratory staff advises (27%). Moreover, they use their own experience in combination with instructions of other local farmers (14.5%), and follow the advice of veterinary drug sellers (41%) (Table 10)

Table 10 Means to disease treatment

N = 90	Own experiences	Other farmers	Laboratory staff	aquaculture extension	Veterinary drug sellers
%	76.0	14.5	47.0	23.0	21.0

Source: Survey data, 2010

In treating fish diseases, farmers exercise several actions: applying recommendation of laboratory experts or following veterinary/aquaculture drug store advise (42.4%), mixing drugs with feed (34.1%), changing pond water or treating pond water using chemicals (18.8%), reducing amount of feed (3.5 %) and use antibiotics (16.5%) (Table 11)

Table 11 Farmers' disease treatment methods

(N = 90)	Ratio (%)
Mix medicine with feed	34.1
Reduce feed	3.5
Water treatment	18.8
Follow lab/drug agents' advice	42.4
Use antibiotics	16.5
Follow other local farmers' advice	1.2

Source: Survey data, 2010.

Farmers evaluate their own experience as very (good) for fish disease diagnosis (81.4%). Aquaculture extension staffs are also very (good) source for consultancy of fish disease (70.9%). (Table 15)

Table 12 Farmers' opinions about fish disease diagnosis

	Very good	Good	Fair	Bad	Very bad
Own experience	48.1	33.3	18.5	-	-
Neighbor farmers	4.5	36.4	45.5	9.1	4.5
Aquaculture extension staffs	29.2	41.7	29.2	-	-
Laboratory test	58.3	25.0	12.5	-	4.2
Veterinary drug sellers	18.5	40.7	33.3	7.4	-
Aquaculture experts	38.9	33.3	27.8	-	-

Source: Survey data, 2010.

- Harvest

At the harvest, farmers presented the production cost in Table 13

Table 13 Cost of Pangasius production

Items	N	Value (VND)
Pond construction	90	5,000,000
Pipeline	90	1,102,400
Feeding machine	90	3,000,000
Boat	90	1,000,000
Storage house	90	2,204,000
Pond preparation	90	6,484,000.5037
Pond treatment	90	3,241,005.4527
Fingerlings	90	237,604,000
Feed	90	3,521,665,000
Disease treatment and prevention	90	223,208,891
Labor cost per person	90	1,002,000.22
Fuels	90	42,771,005.37
Electricity	90	2,116,008.25
Interest rate	90	194,544,000
Harvest transportation	90	10,805,257
Total cost	90	3,940,393,920

Source: Survey data, 2010.

On average, small-scale fish farmers produced about 282,896 tons of marketable Pangasius per ha of water surface area, received VND 14.5 thousand/kg. Total revenue were VND 4,101,994,230, total costs were VND 3,940,393,610, and profit were VND 161,600,310 per ha (Table 14).

Table 14 Cost – Benefit analysis per ha

Items	N	Value (VND)
Yields (tons/ha)	90	282,896
Total revenue (VND)	90	4,101,994,230
Total cost (VND)	90	3,940,393,920
Total profit	90	161,600,310
Price of Pangasius (VND/kg)	90	14,500

Source: Survey data, 2010.

During harvest time there is strict fish quality control by processing firms. Processing firms have a set of requirements for the quality of fish. Moreover, they prefer to buy from farmers with documents for fish traceability (expert interview, 2010). The small-scale farmers stated that the farm gate price is often decided by processing/export firms and fluctuation which based on the current market price (Survey, 2010). There are no guarantees that the processing firms will purchase the fish from the farmer. The processing/export firms stated that quality and quantity of fish which purchased from small-scale farmers were unreliable and did not match processors' demands in many cases.

At the time of harvest, the fish often does not fulfill the prescribed criteria like, for example size and weight. Moreover, there is a risk of buying fish containing antibiotics (Survey, 2010). Table 15 shows the farmers' perception on the importance of designing flexible supply contract in business relationships with processing/export firms. The survey results point out that those who rated "fixing the duration of purchasing fish", "just-in-time payment, "providing proper fish quality specifications", and promising to be a regular buyer as (very) important make up 93%, 88.5%, 63%, and 63%, respectively. On the other hand, those who rated "providing update market information" and "getting access to credit" as (very) important constitute 52.5%, and 50%, respectively. The results confirm that fish farmers are more interested in contractual agreements which allow them to supply fish regularly to processing firms and they can get back money soon.

Table 15 Farmers' perception on the importance of designing flexible supply contract in the business relationships between fish farmers and processing/export firms

(N=90)	Very important	Important	Neutral	Not important	Not important at all
1. Fixing the duration of purchasing fish	49.5	43.5	6.5	0.5	-
2. Promising to be a regular buyer	17.5	46.5	26.0	9.0	1.0
3. Getting access to credit	20.5	29.5	39.0	10.0	1.0
4. Providing proper fish quality specifications	20.5	42.5	15.0	6.5	15.5
5. Providing update market information	18.0	34.5	23.0	23.5	1.0
6. Just- in- time payment	56.0	32.5	8.5	3.0	-

Source: Survey data, 2010.

4 The evaluation of the small-scale fish farmers' constraints to access market

In this section, we use the expert discussion results (2010) to show the small-scale famers' constraints to access market**.** Fish quality issues, price instability of the raw material and the risk of a severe disease outbreak are seen as the major risks for the industry followed by concerns over the environment and the export market (Table 16)

Table 16 Major problems for the Pangasius smallholders as perceived by key-informants

Respondent	Major problems for the Pangasius smallholder farmers
Local authorities of CanTho, An Giang and Dong Thap provinces	- Price instability of the product - Outbreak of diseases - Degradation of fingerling quality
Processing/export firms	- Price instability - Quantity and quality of fish raw material - Smallholder farmers outside the company do not always produce according to the companies standards - Disease outbreaks - More strictly food safety control of import market - Import stop in EU because of high residue levels in the product - Costs of implementing and maintaining a quality system are very high
Fishery associations	- Degradation of fingerling quality - Environmental problems caused by uncontrolled growth - Technical barriers imposed by importing countries (strict regulations on veterinary drugs and chemicals)
NGOs	- Disease outbreaks - Pollution - Increasing price of the raw material. - Big price fluctuation due to bad planning.
Research institutes	- Diseases: In case there will be a severe disease outbreak or something similar to bird flu develops in Pangasius, all farms will be rapidly infected as densities are too high and farmers use each others water. - Price instability of the raw material - The carrying capacity of the environment. - Pangasius industry is growing fast, but capacity is unknown.

Source: Expert interview, 2010

The internal strengths and weaknesses, compared to the external opportunities and threats, can offer an additional insight into the condition and the potential of the business. How can we use the strengths to take more advantage of the opportunities ahead and minimize the harm if the threats become a reality? How can weaknesses be minimized or eliminated? The true value of the SWOT analysis is in bringing this information together, to assess the most promising opportunities, and the most crucial issues. Hence, in this section, the SWOT analysis is applied to analyze the Vietnamese Pangasius industry. Results in the SWOT summed up as follows are based on the survey results (Table 17)

Table 17 SWOT analysis

<table>
<tr><td>Strengths:
Improved farming technique of fish farmers.
An increase in the farming scale.
Improved awareness of fish farmers in using chemical inputs.
Less competition with the substitutes such as chicken, pork, etc.
Farm price affecting the world market price.
Fish farmers' willingness to pay for getting market information and marketing services.
Improved linkage among fish farmers and processors.
High production experience of fish farmers.</td><td>Weaknesses:
Less market information
Low quality of fingerlings and insufficient supply of fingerlings.
Low technique skills of small-scale fish farmers.
Lack of equipments for controlling fingerling and live fish quality.</td></tr>
<tr><td>Opportunities:
The governmental policies favourable for Pagasius sector.
High consumer preference of foreign consumers on the product.
Bird flu, pig disease occurring
Increased income and population for the domestic market.</td><td>Threats:
Price fluctuation
Not easy to control waster sources from other industries, even within this industry.
Climate changes</td></tr>
</table>

4. SUMMARY AND CONCLUSIONS

This research is a result of intensive discussion, interviews and observation in three Pangasius culture provinces in the MRD, Vietnam. Results of this research indicate that farmers are vulnerable actors in the chain. In fact, they have faced many problems with input materials (low quality, high prices, capital, culture techniques, etc.) and output difficulties (prices and markets, etc.).

We found that the smallholders in the chain have weak linkages with input suppliers and processing firms. The results revealed that there is no tracking and tracing at small-scale farm level. Hence, the small farmers and other actors in the chain have to fulfill the quality requirements as they are formulated by the processing companies, in order to make the chain operational. The research also found that the processing firms are relatively well developed as they applied a quality management procedure that has been approved by NAFIQAVED. However, the major challenge is to qualify fish products at farm level to be able to sell to high quality markets. The Pangasius processing/export firms have to strictly control the quality of Pangasius not only inside the company, but covering the whole chain for traceability issue. This is necessary to establish efficient coordination among smallholders together and between smallholders and chain actors in order to improve their participation into global markets. We found that the source of fingerlings which used by small-scale farmers lacking certification. On the other hand, small-scale farmers use higher stocking density which leads to the reduction of fish growth, low survival rate and more fish diseases. One of the most alarming results of we also found that there are not waste-water treatment pond at FA and independent farms. As a result, most of wastes are discharged directly into rivers, and contaminated the environment. Moreover, small-scale farmers mainly manage pond water based on their eye observations, do not use monitoring equipment. Therefore, it leads to disease outbreak in pond farming system. The interesting thing is that small-scale farmers do (treatment) fish disease in different things which based on their own experiences. However, the good news is that farmers are aware of the importance of prevention and proper treatment.

The findings show that problems of small-scale farmers involved in export supply chain can be dealt with through developing business relations between chain actors. To develop a well-organized fish supply chain, it is crucial to encourage small-scale farmers to develop horizontal co-operation among farmers. Farmers need to be trained, organized, and willing to innovate. Horizontal co-operation can improve small-scale farming practices through increased sharing of information and knowledge, development of supportive policies and quality control mechanisms (i.e. a better management practices system). At the same time, it is vital for small-scale fish farmers to develop business relations with processing/export firms by entering into supply contract. Processing/export firms need to be willing to do business with some degree of commitment, allowing small-scale farmers to improve their business performance by learning from their mistakes.

The findings revealed that horizontal integration of small-scale farmers which can be related to group of farmers/fishery association will be beneficial to those members. However, fishery association will not survive without the government intervention. Moreover, the role of processing/export firms is also important in organizing chain quality management.

Farmer group formation is necessary to enable farmers to make the transition from a production to a market orientation. Through the co-operation, farmers can access to inputs, extension more easily, improved produce quality, increase quantity and achieve economies of scale, and increase bargaining power with buyers. Small-scale farmers could improve coordination, transforming their small-scale production system into a common production organization by means of farmer cooperation. They could sign a single contract with the buyers, and rely on third party control for enforcement. This also provides other advantages for complying with larger delivery volumes to buyers. In addition, this would enable negotiations on better conditions for transactions.

The survey results revealed fishery association is a voluntary organization for small-scale farmers in the Mekong Delta. The main duty of the fishery association has been to carry out administrative activities related to extension and marketing services. Fishery association offers services to members like how to apply proper disease treatment, enable financial services and form a platform for connection within the fish chain. The necessary conditions above mentioned that it is needed to organize Pangasius culture on a larger scale under different forms such as farmer groups, farmer association, because these forms can ask for support from local authorities, the processing/export firms' quality control, the extension centre, and NAFIQAVED more easily. On the other hand, through the fishery associations, the processing firms can make official contracts that specify requirements for fish material quality and that introduce attractive policies (supporting of capital, material inputs, training, and price information). It is found that farmers' bargaining position could be stronger if they cooperated with each other.

In Pangasius supply chain, the processing/export firms are generally the most powerful stakeholders, playing a leading role in organizing chain quality management. They get the information from the importers of fish quality standards. Hence, the processing/export firms acts as intermediary, which means on the one hand transferring requirements of importers to the small farmers, and on the other hand informing the importers with respect to production quality. The survey results revealed that small-scale farmers are very dependent on the processing firms. They have less knowledge on the export specifications and regulations. The processing/export firms realized that the quality of fish materials is a very important factor that affects the quality of finished products. However, in practice, the companies did not satisfy quality requirements of fish materials, due to there are not enough conditions to control the quality of fish materials. This is particularly a problem for processing/export firms as they have to transform a heterogeneous input of fish raw material into a uniform output of quality products. In addition, fish raw material comes from many different small-scale farmers. In fact, the processing/export firms has a double coordination problem. Besides the need to align their processing activities with the production activities of small farmers, they have to coordinate the production activities of many different and independent small farmers. To solve these problems, the processing firms can conduct vertical coordination with farmers or contract farming with fishery association (expert interview, 2010).

The role of government is necessary to enable the private sector to organize its supply chains to involve smallholders. The task of government is to provide a well-functioning market, for instance by providing small-scale farmers with information on demand, supply, and prices. Moreover, governments have supported small-scale farmers and producer organization through NGOs. It is necessary to support fishery association/ groups of farmers linking with university researchers who can provide training for advanced farming practices to the needs of farmers.

Government can contribute to provide an effective enabling environment include introducing regulations which relate to food safety and quality, and provision of arrangements to certify inputs quality. In order to implement these activities, it is needed for law enforcement which implies a well-functioning official system. If the official system does not work properly, farmers may be reluctant to enter into exchanges. Moreover, governments can enhance the effectiveness of fishery association participation in international consultative policy processes by helping them gain access to information and providing funds to recruit expertise to prepare inputs into the policy dialogue and seek professional advice.

Shortly, the co-operation type of horizontal and vertical coordination is needed, not only to increase bargaining power of small-scale farmers, but also to create more options for processing/export firms. In our research, horizontal co-operation is important when farmers become involved in the export-oriented chain. Moreover, vertical coordination is suitable for improving the socio-economic performance of small-scale farmers, thus reducing the gaps in the supply chain performance. Vertical coordination seems to be the preferred strategy of farmers. It would be shortened the chain by cutting out traders and other intermediary agents.

The study has identified a number of intervention points that may improve the Pangasius quality control at the farm level. The results show that lack of proper knowledge about fish quality is an important factor to be addressed in order to improve quality. These results imply that investment in the quality control system such as fingerlings, feeds, and veterinary drugs are needed. This however may require even more structural investment at primary level. It may also require better motivation; for example, better price for better quality which was not the case (Survey, 2010). Fish farmers may be compelled to handle fish culture properly if they know that they would be rewarded for it. This means that processing/export firms should be willing to pay for quality. The results also show that fish farmers' position in the supply chain is compromised by lack of price information and interlocked fish markets. Information asymmetries especially over price lead to abrupt price changes and conflicts between farmers and processing firms. There is need therefore to create market information systems and institutions through which price information could be communicated to the fish farmers.

In summary, integrated small-scale primary farmers into export supply chain faces many challenges. Addressing these challenges would imply that either public or private policy should invest in the primary stages to enhance the capacity of independent farmers to complete. Generally, it is necessary to organize Pangasius culture on a larger scale under different forms such as farmer groups, farmer associations, fishery co-operatives, because these forms can ask for support from local managements, the processing/export firms' quality control, the extension center more easily. More consistent supplies and better application of major inputs such as fingerlings, feed, and veterinary services, and an improvement of fish quality can be achieved when cooperation among input suppliers, output processors/exporters, and farmers improves.

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