Original Research Paper

Volume-8 | Issue-1 | January-2018 | PRINT ISSN - 2249-555X

Agricultural Science

DESIGNING AN EFFECTIVE EXPORT-ORIENTED AQUACULTURE SUPPLY CHAIN IN VIETNAM

Dr. Le Nguyen Doan Khoi Assoc. Prof Can Tho University

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.

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

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 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). 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).

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 involves the complex characteristics of food and their raw materials, such as variability, restricted shelf life, potential safety hazards, and the large range of chemical, physical and microbial processes. According to Luning et al. (2006), food quality management is complicated due to it deals with dynamic and complex food systems and people systems involved in realizing food quality. Poon and Lijianage (2003) also 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 food quality products.

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.

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 3.1. The approaches differ in the extent to which they integrate managerial and technological sciences. Technological measures 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 measures concern human behavior and its working environment that can affect food safety. The techno-

managerial approach stresses that it is necessary to integrate the technological and managerial aspects in order to predict food systems behavior, and to generate improvements of the system.

Food safety and quality are major issues not only in Europe and in the US but worldwide. Hanak et al. (2002) argue that governments appear to play a crucial role in helping industries in both developing and developed countries with regard to food safety and quality. Food safety experts from Asia (India, the Philippines, Thailand, Vietnam), Africa (Morocco, Burkina Faso, Ghana, Mauritania, Senegal), and Latin America (Brazil, Costa Rica, Guatemala), representatives of donor agencies (France, Germany, the United Kingdom, WB, FAO, WHO), and members of the European research community also emphasize that food quality assurance can not be implemented successfully in a country without the support of its governments (FAO/WHO, 2005).

Governments are increasingly responsible for: (i) mandating the regulatory requirements; (ii) establish mandated critical limits when necessary; (iii) establish criteria, methods and sampling plans when necessary; and (iv) verify that in individual facilities HACCP plans are adequate in order to assure food safety (Kvenberg et al. 2000; Hanak et al., 2002; Billy, 2002; Ababouch, 2000). According to Suwanrangsi (2002), the provincial government agencies interacting with the fisheries industry are responsible for promoting the sector's development through the introduction of new technologies, extension, research, training, regulation and inspection. Additionally, the government should use epidemiological and scientific data to identify hazards and conduct risk evaluations, to manage food safety in a more efficient manner and reassure public confidence in the food supply. Such measures include regulations and policies, guidance on hazards, risk communication and education, incidents and crisis management (Lee and Hathaway, 1999; Motarjemi and Mortimore, 2005).

Besides these national responsibilities governments of developing countries face responsibilities on the international arena. Governments that are not actively present in the WTO and the international standard setting bodies like the Codex Alimentarius Commission are unable to promote the interests of their domestic food industries. However, governments in the developing world face multiple demands, and have a limited capacity to respond. Donor agencies may play a key role in improving developing country food safety management. This includes facilitating exchanges to build regional networks, support to improve the advocacy capacities of developing countries in international forums, assistance in getting science-based information for certain tropical pesticides and bacteria and other contaminants, build up networks of laboratories, etc. Or for instance, to develop appropriate management techniques for a supply chain facing marketing constraints is clearly a useful mechanism.

3. Research Methodology

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 1).

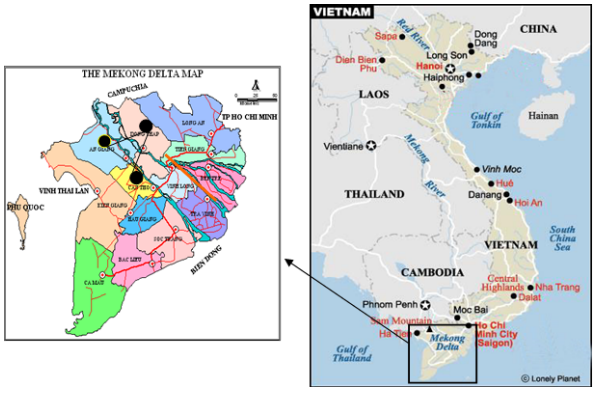

Figure 1 The map of MRD with three different studied locations in Vietnam

4 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 1. 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 1 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 2).

Table 2 Source of fingerlings

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

Source: Survey data, 2010

To identify the relationship between farmers' awareness and willingness regarding certified fingerlings, a cross-tabulation is made and an analysis of variance is applied (H0: there is no relationship between awareness and willingness of farmers toward the adoption of certified fingerlings). We test the correlation of the Yes/No answers of farmers' awareness and willingness. We neglected the farmers who were not able to express their opinion. The difficulty with this part of the test population is that various reasons may explain why they are not able to answer this question. To avoid ambiguity in the interpretation of the results, we decided to exclude them from this exercise.

The test results indicate that, concerning both groups of farmers, the null hypothesis is rejected at the 1% significance level for independent farmers and FA farmers respectively (Table 3). In other words, a relation exists between farmers' awareness and willingness to use certified fingerlings. The results show that 61.1% of independent farmers and 92.0% of the FA members aware of the better quality of certified fingerlings are also willing to purchase the fingerlings with a premium price.

Table 3: Relation between awareness of certified fingerlings and willingness to purchase certified fingerlings with price premium

Group of farmer				Willingness to purchase certified fingerlings with price premium		
				No	Yes	Total
Independent farmer	Awareness of certified fingerlings better quality than non-certified ones.	No	Count	15	9	24
			% within Awareness of certified fingerlings	62.5%	37.5%	100.0%
		Yes	Count	4	14	18
			% within Awareness of certified fingerlings	22.2%	77.8%	100.0%

		Total	Count	19	23	42
			% within Awareness of certified fingerlings	45.2%	54.8%	100.0%
FA member	Awareness of certified fingerlings better quality than non-certified ones.	No	Count	6	12	18
			% within Awareness of certified fingerlings	33.3%	66.7%	100.0%
		Yes	Count	0	25	25
			% within Awareness of certified fingerlings	.0%	100.0%	100.0%
		Total	Count	6	37	43
			% within Awareness of certified fingerlings	14.0%	86.0%	100.0%

Group of farmer		**Asymp. Sig. (2-sided)**
Independent farmer	Pearson Chi-Square	.009**
FA member	Pearson Chi-Square	.002**
**significant at 5% level		

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

To identify the relationship between farmers' awareness of applying and willingness to apply certified industrial feed, an analysis of variance is applied to test the null hypothesis (H0: there is no relationship between farmers' awareness of the better quality of industrial feed and farmers' willingness to buy industrial feed). The results indicate that for both groups of farmers, the null hypothesis is rejected at the significant level of 1% (Table 4). In other words, a relationship exists between farmers' awareness of applying and willingness to apply certified industrial feed. The results show that 66.7% of the independent farmers and 78.1% of the FA members who are aware of the better quality of certified industrial feed are thus willing to use industrial feed in the whole production cycle.

Table 4 ***Relation between awareness of better quality of industrial feeds and willingness of using industrial feeds in the whole of production cycle.***

Group of farmer				**Willingness to use only industrial feeds for the whole production cycle**		
				No	**Yes**	**Total**
Independent farmer	Awareness of better quality of industrial feeds	No	Count	12	0	12
			% within Awareness of better quality of industrial feeds	100.0 %	0%	100.0%
		Yes	Count	9	18	27
			% within Awareness of better quality of industrial feeds	33.3%	66.7%	100.0%
		Total	Count	21	18	39
			% within Awareness of better quality of industrial feeds	53.8%	46.2%	100.0%
FA member	Awareness of better quality of industrial feeds	No	Count	8	0	8
			% within Awareness of better quality of industrial feeds	100.0 %	.0%	100.0%
		Yes	Count	7	25	32
			% within Awareness of better quality of industrial feeds	21.9%	78.1%	100.0%
		Total	Count	15	25	40
			% within Awareness of better quality of industrial feeds	37.5%	62.5%	100.0%

Group of farmer		**Asymp. Sig. (2-sided)**
Independent farmer	Pearson Chi-Square	.000**
FA member	Pearson Chi-Square	.000**
**significant at 1% level		

Source: Survey data, 2010.

- Fish disease treatment

To test the relationship between farmers' awareness and willingness regarding the use of certified veterinary drugs, a cross-tabulation analysis is applied

(H0: there is no relationship between farmers' awareness that certified drugs are better than non-certified drugs and farmers' willingness to use certified veterinary drugs for fish disease treatment). The testing results reveal that, concerning independent farmers, the null hypothesis is not rejected (Table 5), that is, no relationship exists between awareness of certified veterinary drugs and willingness to use them.

However, the test result for the null hypothesis is rejected at the significant level of 1% concerning FA members. In other words, a relationship does exist between awareness of applying and willingness to apply certified veterinary drugs. The results show that 75.0% of FA members are aware that certified veterinary drugs are of better quality than non-certified drugs, and thus they are willing to use certified drugs only.

Table 5 Relation between awareness of better quality of certified veterinary drugs and willingness to use certified veterinary drugs

Group of farmer				**Willingness to use certified veterinary drugs**		
				No	**Yes**	**Total**
Independent farmer	Awareness of better quality of certified veterinary drugs	No	Count	9	23	32
			% within Awareness of better quality of certified veterinary drugs	28.1%	71.9%	100.0 %
		Yes	Count	6	9	15
			% within Awareness of better quality of certified veterinary drugs	40.0%	60.0%	100.0 %
		Total	Count	15	32	47
			% within Awareness of better quality of certified veterinary drugs	31.9%	68.1%	100.0 %
FA member	Awareness of better quality of certified veterinary drugs	No	Count	9	12	21
			% within Awareness of better quality of certified veterinary drugs	42.9%	57.1%	100.0 %
		Yes	Count	1	27	28
			% within Awareness of better quality of certified veterinary drugs	3.6%	96.4%	100.0 %
		Total	Count	10	39	49
			% within Awareness of better quality of certified veterinary drugs	20.4%	79.6%	100.0 %

Group of farmer		**Asymp. Sig. (2-sided)**
Independent farmer	Pearson Chi-Square	.416
FA member	Pearson Chi-Square	.001*
**significant at 1% level		

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 6)

Table 6 Major problems for the Pangasius sector as perceived by key-informants

Respondent	Major problems for the Pangasius sector
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 - More strictly food safety control of import market
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	- 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

5. 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.).

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 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. 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.

References

1. Amanor, K.S. (2009). "Global food chains, African Smallholders and World Bank governance." Journal of Agrarian Change, vol.9, no.2, 247-62.
2. Bush, S.R., N.T. Khiem, and L.X. Sinh (2009). "Governing the environmental and social dimensions of Pangasius production in Vietnam: a review." Aquaculture Economics and Management, vol. 13, no. 4, 271-93.
3. Khoi, L.N.D., J. Wijngaard, and C. Lutz (2008) "Farming system practices of seafood production in Vietnam: the case study of Pangasius small-scale farming in the Mekong River Delta." ASEAN Business Case Studies, no. 27. Centre for International Management and Development. Antwerp, Belgium: University of Antwerp.
4. Lang, V.T., K.Q. Vinh, and N.T.T. Truc (2009). Environmental consequences of and pollution control options for Pond "Tra" fish production in Thotnot district, Cantho City, Vietnam, EEPSEA, research report, no.20009-RR3.
5. Mantingh, I., and N.V. Dung (2008). Pre-assessment of Pangasius sector: toward sustainability. Dutch Ministry of Agriculture, Nature, and Food Quality.
6. Phuong, N.T and D.T.H. Oanh (2009), "Striped catfish aquaculture in Vietnam: A decade of unprecedented development. In Success stories in Asian Aquaculture, 41-66, NACA.
7. Reilly, A. and F. Kaferstein (1997). "Food safety hazards and application of the principles of the hazards and critical control point (HACCP) system for the control of aquaculture production." Aquaculture Research, vol. 28, 735-52.
8. Schut, S. (2009). Governance Interactions of Environmental Certification and the Vietnamese Pangasius Farming Industry. MSc thesis, Department of Social Sciences, Wageningen
9. Suwanrangsi, S. (2000), "Experiences in the application of HACCP for export and local markets: the case of Thai fisheries", Proceedings of the International Workshop, Montpellier, France.