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Food Quality Awareness: Cases from Shrimp Producers in Thailand and Vegetable Producers in Vietnam

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March 2016

Abstract The high number of import rejections of food commodities suggests that producers in exporting countries are not complying with established standards. To understand why this is the case, we explore the behavior of producers and consumers in developing countries. First, we examine the successful transformation of production practices adopted by shrimp producers in Thailand. In support of the dramatic change in practices, we observe an important role played by the public sector in providing a means to visualize chemical residues and to control processes upstream of the supply chain via a registration system and a traceability system called Movement Document. Furthermore, very active information sharing by the private sector contributes to the dissemination of useful technical and market information among producers. We also examine the knowledge and perceptions of consumers with respect to food safety in Vietnam. We find that consumers in Hanoi and Ho Chi Minh City behave differently toward the third-party certification VietGAP, probably owing to differences in the history of market mechanisms between the two cities.

Keywords: Food Standards Compliance, Traceability, Aquaculture, Social Network, Good Agricultural Practice

JEL classification: D12, L15, O13, O19

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Food Quality Awareness:

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1. Introduction

One of the major reasons for import rejections of food commodities at the ports of developed countries, such as the US, Japan, and countries in the EU, is the detection of high levels of chemical residues (UNIDO, 2013). Chemical residues may originate from chemical fertilizers, pesticides, herbicides, or antibiotics used during production. These are considered to have harmful effects on humans; thus, the maximum level of residues allowed is often set by importing countries, though the levels vary among countries.

Antibiotic residue is a major problem for fish and fishery products (UNIDO, 2013). Antibiotics are used during production to prevent or treat diseases. In particular, antibiotic residue is a major issue for shrimp products because disease control is a challenge in the modern intensive shrimp production system. The detection of high levels of antibiotic residues leads to stricter inspections of shipments. For example, 100% of shrimp shipments exported from Vietnam from May 2012 until January 2014 were inspected following the detection of ethoxyquin. This raised the costs of inspection by Vietnamese processors and exporters. In Japan, names of companies whose shipments are rejected are recorded and made public online. Thus, import rejection is costly for exporters (UNIDO, 2013).

However, as many shrimp-producing countries rely on small-scale production of shrimp in Asia, except for the case of Indonesia, it is difficult to control and regulate the production practices of numerous small-scale producers (Hall, 2004). Large-scale ponds owned by processor-exporters do exist in these countries, but companies can typically only source less than 20% of their processing capacity from their internal vertically integrated production system. For the remaining share, processing companies rely on purchases from external traders, who combine the shrimp purchased from many

small-scale shrimp farmers. Although many governments and international organizations are making efforts to disseminate information on good management practices to the level of small-scale farmers, the high incidence of port rejections due to antibiotic residues shows that this remains an important issue in many countries. This type of production system makes it difficult to regulate the production practices of smallholders and to assure traceability from the downstream to upstream levels of farmers.

In this context, the Thailand shrimp sector has shown a successful transformation regarding the use of antibiotics. Until the early 2000s, when black tiger was the major type of shrimp produced in Thailand, antibiotics were regularly used by farmers to treat diseases. However, when a serious disease outbreak occurred around 2003–2004, including the white spot syndrome virus, farmers used antibiotics heavily to treat diseases, which led to a high import rejection of Thai shrimp in the US, EU, and Japanese markets. Experiencing a huge drop in export volume, stakeholders in the Thailand shrimp sector got together to change small-scale farmers' production practices. Since then, farmers have changed their production practices; currently, the use of antibiotics is not common. We examine how this transformation was possible and how shrimp are currently treated without antibiotics.

Another component of food safety improvement is related to the level of domestic consumer awareness about safe food; accordingly, we also examine how consumers in developing countries consider food safety, using Vietnam as a case study. We conducted a survey of consumers regarding their awareness of food quality in two cities, Hanoi in the north and Ho Chi Minh City in the south. We examine whether consumers trust the market-based certification VietGAP and whether consumer

awareness is different between these two cities.

In the next section, we describe an overview of the Thailand shrimp sector, and in section three, we discuss factors that contributed to the successful transformation of farmer practices. The fourth section summarizes a survey conducted in Vietnam regarding domestic consumer awareness about food safety. A conclusion follows.

2. Overview of the shrimp industry in Thailand

2.1 History

Shrimp production and exports in Thailand play an important role in the economy. The Thai government has actively promoted development in this sector as part of its national policy, as a kitchen of the world. According to Szuster (2006), the development of the shrimp industry in Thailand can be divided into the following periods.

The first period is before 1971, when natural farms were used. Shrimp farming in Thailand has developed from a traditional form of extensive to semi-intensive monoculture techniques since the early 1970s. According to Lebel et al. (2002), extensive production systems in Thailand began as early as 1957 in Nakhon Si Tammarat. During this period, wild shrimp from seawater were captured and raised in paddy fields before each rice crop. Both seed and feed were obtained naturally from the sea and tidal flows. Shrimp species cultured during this period include the banana shrimp (*Fenneropenaeus merguiensis*), Indian white shrimp (*F. indicus*), school shrimp (*Metapenaeus monoceros*), and black tiger shrimp (*Penaeus monodon*). Farmers and the government invested little in infrastructure during this period.

The second period is from 1972 to 1987, when semi-intensive monoculture techniques became available and black tiger shrimp fry were successfully raised in

hatcheries. Black tiger shrimp were the main species produced because they grow quickly in artificial conditions and have a high export value (Pillay, 1990). During this period, feed quality improved, and this made domestic culture possible. Investment by farmers during this period started to increase, but was still low. State support for shrimp farming in Thailand existed since 1973, with the promotion of hatcheries. Assistance from the Thai government and international organizations, such as the Asian Development Bank increased in the late 1980s (Hall, 2004). Thai government support, including tax and other incentives, promoted the construction of a great number of shrimp ponds in the early 1980s (Saisithi, 1989).

The third period is from 1988 to 1995, during which intensive farming expanded rapidly and intensive farming techniques were developed. A controversial problem that arose from the earlier extensive shrimp farming in Thailand was the destruction of mangrove forests. Accordingly, the expansion of intensive shrimp farming into inland regions and rice fields is considered more environmentally friendly. Shrimp culture during this period was characterized by high stocking density, mechanical aeration, prepared feeds, and the heavy use of fertilizers, chemicals, and antibiotics (Flaherty and Karnjanakesorn, 1995). According to Pongthanapanich and Roth (2006), intensive shrimp farming in Thailand, characterized by high stocking density and the use of artificial feed and chemicals, increased from about 50% in 1990 to nearly 90% in 2003 in terms of the number of farms and from more than 35% in 1990 to almost 80% in 2003 in terms of production, which was dominated by black tiger shrimp (*Penaeus monodon*), accounting for around 90% of cultured shrimp (Rosenberry, 1998).

With intensive shrimp production, the industry has shifted from labor-intensive to capital-intensive and encountered remarkable challenges. The rapid increase in

intensive farming has had environmental impacts, such as water pollution, which deteriorate the shrimp pond environment and resulted in disease outbreak in 1996. According to Szuster (2006), not long after the boom, more than 80% of farms located in the Upper Gulf of Thailand were abandoned due to diseases. Many shrimp ponds in this region, which were used to grow fish or crabs, became idle or were converted to houses and factories. As a result, shrimp farming moved to the eastern and southern coastal regions in Thailand in the early 1990s. More than 80% of farms in Thailand are small-scale, defined as less than 1.6 ha per farm. These small farms had minimal investments and many difficulties in applying good management practices; accordingly, they suffered from losses when diseases spread. The relocation of farms was preferable to capital investment, especially given the government's investment in roads and infrastructure (Huitric, 1998). There were again viral disease problems in eastern and southern Thailand in 1996 that caused a large decrease in shrimp output (Department of Fisheries, 2002). Coastal shrimp production continued to decrease during the late 1990s.

From 1987 to 1995, the yield of cultured brackish water shrimp in Thailand continued to grow. However, it started to decrease in 1995 (Huitric et al., 2002). Large crop losses were observed in 1996. Export quantity and export value dropped by 13% and 17%, respectively. Export markets shifted from high-income countries, like Japan, the USA, and countries in the EU, to lower-income ones, such as China, which have less strict standards for shrimp imports (Goss et al., 2000). This forced farmers in Thailand to reduce stocking densities and intensive farms were reduced from 84% of farms in 1995 to 25% in 1999 (Department of Fisheries, 1996; Rosenberry, 1999).

In addition to the widespread incidence of diseases, intensive shrimp farming in inland Thailand was criticized for polluting the environment by discharging water into

freshwater areas and threatening the rice bowl of the country. According to Flaherty et al. (1999), environmental reporters for Thai media argued that the rice bowl and food security were at risk. Domestic and international NGOs protested against inland shrimp farming and organized a letter-writing campaign to the Prime Minister. In June 1998, the National Environment Board recommended that the Prime Minister ban shrimp farming in the freshwater areas of ten Central Plains provinces under Article 9 of the 1992 Environmental Protection Act. In contrast, the Ministry of Agriculture and Cooperatives, which contains the Department of Fisheries (DOF), supported shrimp farmers. The DOF argued that Article 43, which is not as strict as Article 9, of the Environmental Protection Act should be applied. This article permits inland shrimp farms that use a closed system. Farmers would not be allowed to discharge waste water into natural waterways. Pond waste from shrimp farming would have to be treated on site. Additionally, farmers are responsible for possible damage to neighboring rice farmers' properties. This debate could be considered a trigger for the development of a new system for intensive farming in inland regions in Thailand. Nevertheless, in July 1998, a ban on inland shrimp farming was enacted and extended to include all provinces, although shrimp farming in brackish water and estuarine areas was still allowed. The ban came into effect 120 days after the order appeared in the Royal Gazette so that farmers could harvest their last crop.

By the late 1990s, the Thai government recognized the problem and began initiatives in collaboration with international organizations, such as WB, to implement actions, such as voluntary adoption of the Code of Conduct (CoC) and Good Aquaculture Practice (GAP). The Thai government started to support research to improve aquaculture techniques and natural resource management practices and

provided training and extension services to farmers (Kongkeo, 1997).

The fourth period extends from 1995 to the present. During the mid-1990s, low-salinity shrimp farming techniques, which combine fresh water with hypersaline water purchased from coastal salt pans or saltwater concentrate operations, were developed. Freshwater inputs are also used to offset evaporation and seepage losses. This technique can reduce salinity levels to nearly zero by harvest, unless supplementary saline water or bagged salt is applied. Even though shrimp produced by these techniques are smaller and of lower quality than those produced in coastal areas, they allow rice farmers in central Thailand to convert rice fields into shrimp ponds, which yield higher profits than rice. These techniques also require a shorter culture period, making two or even three shrimp crops per year possible.

The Department of Fisheries under the Ministry of Agriculture and Cooperatives (DOF) is a key governmental body responsible for the development of the Thai shrimp industry. The DOF has developed strategic plans for the Thai shrimp industry. The third plan is currently active for 2014–2016 (Department of Fisheries, 2014). Government and international institutions have also provided great support to farmers, including financial support, research and extension services, and infrastructure development, such as roads and canals in coastal areas. Propaganda by active government organizations, associations, and clubs of farmers, has been used to minimize and stop the use of antibiotics and other prohibited substances. In the meantime, government subsidies and support from other international organizations have raised awareness and influenced the use of probiotics and other methodologies to culture shrimp.

Large companies have also actively supported the development of the shrimp industry. For example, the Charoen Popkhand (CP) Group, which is a large

Thailand-based multinational corporation, formed a joint venture with a large Japanese company, Mitsubishi, and employed experienced Taiwanese technicians to establish CP Aquaculture. The highly vertically integrated company has a long history of experience and extensive investment in feed mills that can be redirected toward aquaculture inputs. It is involved in many related industries, such as the production of shrimp feed, pharmaceutical sales, processing, and exporting (Goss et al., 2000). CP even established the Shrimp Culture and Research Development Company to create shrimp varieties with improved disease resistance and to provide advice and disease control methods to farmers in its production circuits. In addition, in the mid-1990s, CP transferred some of its shrimp operations to other parts of Southeast Asia, including Indonesia, China, Vietnam, and India.

According to Hall (2004), several major factors are associated with the success of shrimp farming in southern Thailand. First, farmers have reduced massive overstocking since the late 1980s. Second, the government supports the industry by providing infrastructure, such as roads and water treatment systems. Third, innovations in farming techniques, such as semi-closed or closed water circulation systems, clean and fully domesticated broodstock, and the use of probiotics, have been consistently pursued by Thai shrimp farmers.

2.2 Volume of Exports and Destinations

Currently, Thailand exports approximately 90% of the shrimp it produces. Thailand accounts for around one-fifth of the world shrimp production and is also credited as one of the top three producers in the global export market (Global Trade Atlas, cited from NFI 2014).

As shown in Figure 1, the volume of shrimp exported from Thailand has fluctuated over time. The export volume declined in 2002 due to disease outbreak in black tiger shrimp. However, it started to increase again following the adoption of a new type of shrimp, *Litopenaeus vannamei*. This species originated in Latin America and was disease-free. The export volume increased steadily until it reached a peak in 2010, after which it started to decline due to a new disease affecting *L. vannamei* named Early Mortality Syndrome. In 2015, exports increased slightly again. Among shrimp-producing countries, India and Ecuador, in particular, are expanding the volume of exports to international markets (Table 1).

With respect to the destination of Thai shrimp, the US is the largest market as of 2015, followed by Japan and the EU (Table 2). During the 1990s, there was a remarkable shift in Thai shrimp export markets. In 1988, Thailand exported twice as much shrimp to Japan as to the USA. In 2001, the quantity of shrimp exported from Thailand to the USA increased dramatically and was more than six times greater than exports to Japan (Ryûken, 2002). Exports from Thailand have increased in a segmented manner, with some processors specializing in export to American, European, and Asian markets and others, such as Japanese processors, allying with general trading companies that focus on exporting to Japan (Hall, 2004).

Source: Thailand Shrimp Association (2015)

Figure 1: Thai Shrimp Export 1997-2014

Table 1: World Shrimp Export

(Volume in tons, Value in million USD)

	2010		2011		2012		2013		2014	
	Volume	Value	Volume	Value	Volume	Value	Volume	Value	Volume	Value
India	184,130	1,099	240,437	1,581	280,157	1,742	252,559	2,569	361,058	3,895
China	274,945	1,800	305,235	2,188	273,656	2,253	269,940	2,538	219,704	2,378
Ecuador	148,977	838	188,098	1,183	210,182	1,288	225,678	1,821	248,245	2,110
Indonesia	137,170	1,036	152,152	1,285	148,540	1,235	152,276	1,582	182,728	1,991
Thailand	425,403	3,197	392,321	3,484	351,992	3,104	212,724	2,252	146,160	1,802
Others	861,945	5,231	875,426	5,961	891,001	5,497	1,097,624	6,142	999,377	6,605
Total	2,032,570	13,203	2,153,669	15,685	2,155,527	15,122	2,211,800	16,906	2,157,272	18,783

Source: Office of Agricultural Economics (2015)

Table 2: Thai Shrimp Export Destination

(Volume in tons, Value in million THB)

	Jan.-Nov. 2014		Jan.-Nov. 2015		% change	
	Volume	Value	Volume	Value	Volume	Value
ASIA	53,133	19,486	56,878	18,851	7.05	-3.26
China	2,085	632	3,776	1,314	81.10	107.91
Japan	35,921	13,981	34,589	12,533	-3.71	-10.35
Others	15,127	4,873	18,513	5,004	22.38	2.69
USA	59,662	24,612	65,521	22,648	9.82	-7.98
EU	16,964	7,605	7,987	3,174	-52.92	-58.26
Australia	6,013	2,403	5,401	1,951	-10.18	-18.81
Others	10,365	4,110	9,748	3,367	-5.95	-18.08
Total	146,137	58,216	145,535	49,991	-0.41	-14.13

Source: Thailand Shrimp Association (2015)

2.3 The supply chain of Thai shrimp exports

The shrimp supply chain in Thailand is summarized in Figure 2. Upstream of the process is fry production, in which hatcheries and fry collectors buy shrimp larvae from large-scale and backyard hatcheries. Recently, the number of backyard hatcheries has decreased. Fry mature and are ready to be sold after about 15 to 20 days.

Shrimp fry is sold to both grow-out farmers and large vertically integrated shrimp companies. Some companies produce fry and other inputs by themselves. Grow-out farmers buy other inputs, such as feed and probiotics, from input suppliers. These input suppliers can include large shrimp companies, such as CP Corporation. Most grow-out farmers operate at a small scale. Only a few large companies are included in this node. The most prominent example is Charoen Pokphand Food (CP Foods), which is a vertically integrated company comprising feed manufacturers, stock farms and factories, and processing plants. Another large company is Thai Union Frozen Products, which is a leading global seafood processor. Many grow-out farmers are members of clubs, where they can effectively exchange information about markets and

technical issues. Farmers can be independent or contracted by processors or large companies.

About 90% of shrimp in Thailand are exported, and the rest is sold in the domestic market through traders or brokers. In domestic markets, traders sell shrimp directly to retailers or through wholesale markets. In export markets, traders sell shrimp through wholesalers, retailers, and specialty shops. Large shrimp companies also process and export shrimp products to overseas markets. Major export markets for Thai shrimp include the USA, Japan, EU, Canada, the UK, and other countries. The USA is the single largest market for Thai shrimp exports. Shrimp exporters in Thailand are required to join the Thai Frozen Food Association (TFFA). Only companies that are members of the TFFA have access to export markets. These processors also import shrimp from abroad for processing and export.

Based on DOF registration records, Thailand has over 20,700 shrimp farmers and 740 hatcheries as of February 2015 (Table 3). Shrimp ponds account for a total of 331,731 rai (53,076 hectares) for farms and 81.3 rai (13 hectares) for hatcheries.

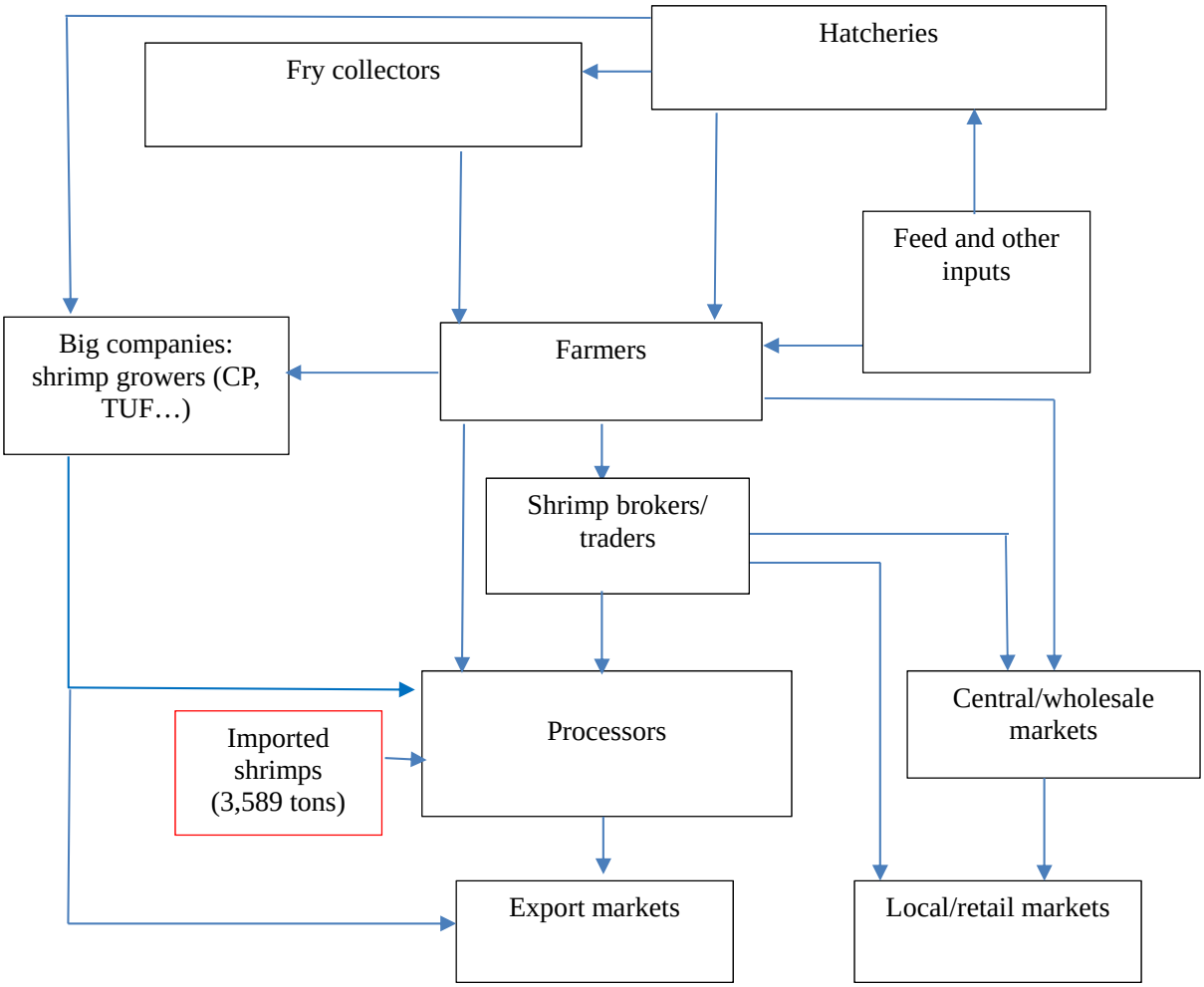


Figure 2: The supply chain of Thai shrimp export

Source: Thailand Development Research Institute (2010), National Food Institute (2014) and Tuiviang (2014)

Table 3: Number of Registered Shrimp Farms and Farmers (as of Feb. 16, 2015)

	Black Tiger Shrimp			Vannamei Shrimp		
	# farmers	# farms	area	# farmers	# farms	area
Shrimp Hatcheries	150	175	27.37	594	705	53.93
Shrimp Farms	3,191	3,218	73,469	17,562	18,599	258,262

Source: Department of Fisheries (2015)

2.4 The production practices of farmers

In the early years of intensive shrimp farming, the farmers applied an “open system” culture, which requires the exchange of high volumes of saline water to maintain water quality. About 30% to 40% of the water volume in a pond is changed per day during the late stage of shrimp growth. As a result, the quality of water in public areas can be easily contaminated with pollutants and pathogens via water discharged from individual farmers’ shrimp ponds and diseases can be transmitted to a wide area. After a disease outbreak in 1996, farmers switched to a new system that uses less water exchange, or a “closed system” culture that significantly reduces water exchange between individual ponds and public water sources. Fresh and salt water is only added during the grow-out phase to offset losses from water seepage and evaporation. A typical system contains at least one pond to store and treat water using Tilapia fish grown in the pond before it is added to the shrimp ponds. Additionally, at least one pond is reserved to treat water that is discharged from shrimp ponds before reuse. These changes in culture techniques allow farmers to get away from coastal areas and establish inland farming. Importantly, a new shrimp variety, *Penaeus monodon,* enables these changes because it can withstand large fluctuations in temperature and salinity (Laubier, 1990). Larvae that are acclimatized to low salinity levels have been supplied by hatcheries to meet the new demand of farmers.

Waste management is another issue in shrimp farming in Thailand. Farmers use artificial feed produced from fish meal in Thailand. Thus, there is high organic accumulation on the bottom of ponds and high sediment production, which may become harmful to shrimp and may cause pollution when sediments are discharged to the environment. In the past, many farmers have discharged sediments directly into

irrigation canals, polluting inland fresh water systems. Furthermore, the accumulation of sediments in small irrigation canals blocks downstream farmers from access to water.

In the past, various chemicals, aquatic vegetation, and other nuisance organisms have been used in shrimp culture to control diseases, including bactericides, fungicides, parasiticides, algicides, and herbicides. Many farmers use antibiotics to prevent disease outbreaks by purchasing medicated feeds. However, for the last two decades, many campaigns and programs have been developed by government organizations, associations, and large companies to prevent farmers from using antibiotics. Instead, farmers are increasingly using probiotics to prevent shrimp from getting disease. About 10 years ago, when probiotics were first introduced, very few farmers were aware of them and many were reluctant to use them. With government subsidies, farmers started to use probiotics and observed their effectiveness. Thus, probiotics are now widely known among farmers.

Additionally, shrimp culture in some areas in Thailand is coupled with Tilapia fish growth. According to farmers, the addition of Tilapia fish to shrimp ponds reduces shrimp death. This was a coincidental finding, but farmers later learned that there is a scientific explanation for this pattern. Tilapia fish are beneficial for shrimp farming because they eat shrimp waste and help to treat water by reducing bacteria. The density of Tilapia fish in shrimp ponds is lower than that in water-treatment ponds. Farmers, therefore, not only harvest shrimp, but can also receive income from Tilapia fish.

3. Factors contributing to the successful transformation

According to Holmstrom et al. (2003), farmers in Thailand regularly used antibiotics as of 2000, when they conducted field survey in villages along the Thai Coast. They

estimated that approximately 74% of all respondents used antibiotics, both for preventive and antiviral purposes. The most common antibiotics used were norfloxacin, oxytetracycline, enrofloxacin, and various sulfonamides (Holmstrom et al., 2003, p. 257). At this time, black tiger was the main shrimp species produced in Thailand. An outbreak of *white spot syndrome virus* in the early 2000s led farmers to rely on antibiotics to treat the disease, and the US and EU decided to ban the import of Thai shrimp owing to the detection of residues. This explains the declining export volume from Thailand in the early 2000s (Figure 1).

This experience was an important lesson for the Thai shrimp sector. The new species, *L. vannamei*, was introduced in Thailand in 2003 and began to spread owing to its higher disease resistance. More farmers are trying to switch production to the new species. In addition, because the Thai shrimp sector experienced high rates of import rejection, they were determined to change production behavior related to the use of antibiotics. As a result of a series of efforts by various stakeholders, as of 2016, farmers appear to have changed their production behavior dramatically. Based on interviews, it is rare for farmers to use antibiotics during the grow-out period. To minimize the possibility of disease outbreak, farmers implement various preventive measures, including the use of probiotics, careful water treatment using two reservoir ponds, adopting a lower stocking density, removing organic elements from the pond regularly, and so on. Although they are labor-intensive, these production practices are highly recommended and supported by the government and the private sector as a whole.

To reduce antibiotic usage, it is necessary to start with the pond. Controlling production practices in the pond is relatively easy if the ponds are consolidated and controlled by a few owners. However, in Thailand and many other shrimp-producing

countries, small-scale production is common. The dominance of small-scale production is explained by the labor-intensiveness and high level of care needed. According to one processing company owner, “Shrimp are very delicate animals and shrimp culture is something very special. Small-scale owner-managers do the best in management. Some processors also have their own ponds to raise their shrimp internally, but the share of shrimp they produce relative to their processing capacity is less than 10%. Once the pond becomes large, it becomes too difficult to monitor the health of shrimp every day.”

Thus, 80% of shrimp produced in Thailand are cultured by private farmers, rather than large integrated companies. However, this structure involving many farmers poses a challenge with respect to assuring a consistent quality of shrimp because it is difficult to enforce systematic production practices. In fact, the same situation prevails in all shrimp-producing countries as many of them rely on small-scale production. Thus, it is very important to understand how Thailand can change production practices at the pond level. Based on our study, we believe that at least three factors contributed to the successful transition.

3.1 Access to a public laboratory

First, the government (DOF) provides easy access to public laboratories to test the health and residues of shrimps free of charge. It is difficult for farmers to assess chemical residues, which are unobservable unless they are formally detected in scientific laboratories. It is also usually very costly for farmers to conduct these tests, both in terms of access to these facilities and the physical costs of analyses.

In Thailand, as of 2016, this service is provided to farmers by the DOF, free of charge. There are three large laboratories, in Bangkok, Samu Sakorn, and the south. In

addition to these large-scale laboratories, there are many regional public laboratories, and farmers can test their fry before purchasing them from input suppliers. As the quality of shrimp fry is a very important determinant of the quality of the final shrimp output, it is important to stock healthy fry.

Farmers also use these laboratories when they want to test the health of their cultured shrimp during production. One farmer we met checks his shrimp once every week and obtains next-day results. To conduct antibiotic tests at a private laboratory is costly (as much as USD 80–100 per pond). Thus, without these public services, it is difficult for farmers to determine the true health of the shrimp. The Thai government offers free services for farmers, and this not only ensures that farmers use high-quality fry to stock ponds, but also raises farmer awareness with respect to quality. Although there is a debate regarding whether the government should shoulder testing fees, it is critically important that farmers have easy access to public laboratories as they otherwise do not have the opportunity to evaluate the true quality of their shrimp.

3.2 Government control and regulations

Traceability via Movement Documents and IDs

Another government contribution is their effort to ensure traceability by requiring farmers to register and to use what is called the Movement Document (MD). To culture shrimp in Thailand, a farmer needs to register with the DOF and have an ID. This ID is required when farmers want to use a public laboratory, receive subsidized probiotics, or even when they sell their shrimp to collectors. Good Aquacultural Practice certification is also necessary if a farmer wants to sell shrimp to a collector, both in domestic and export supply chains.

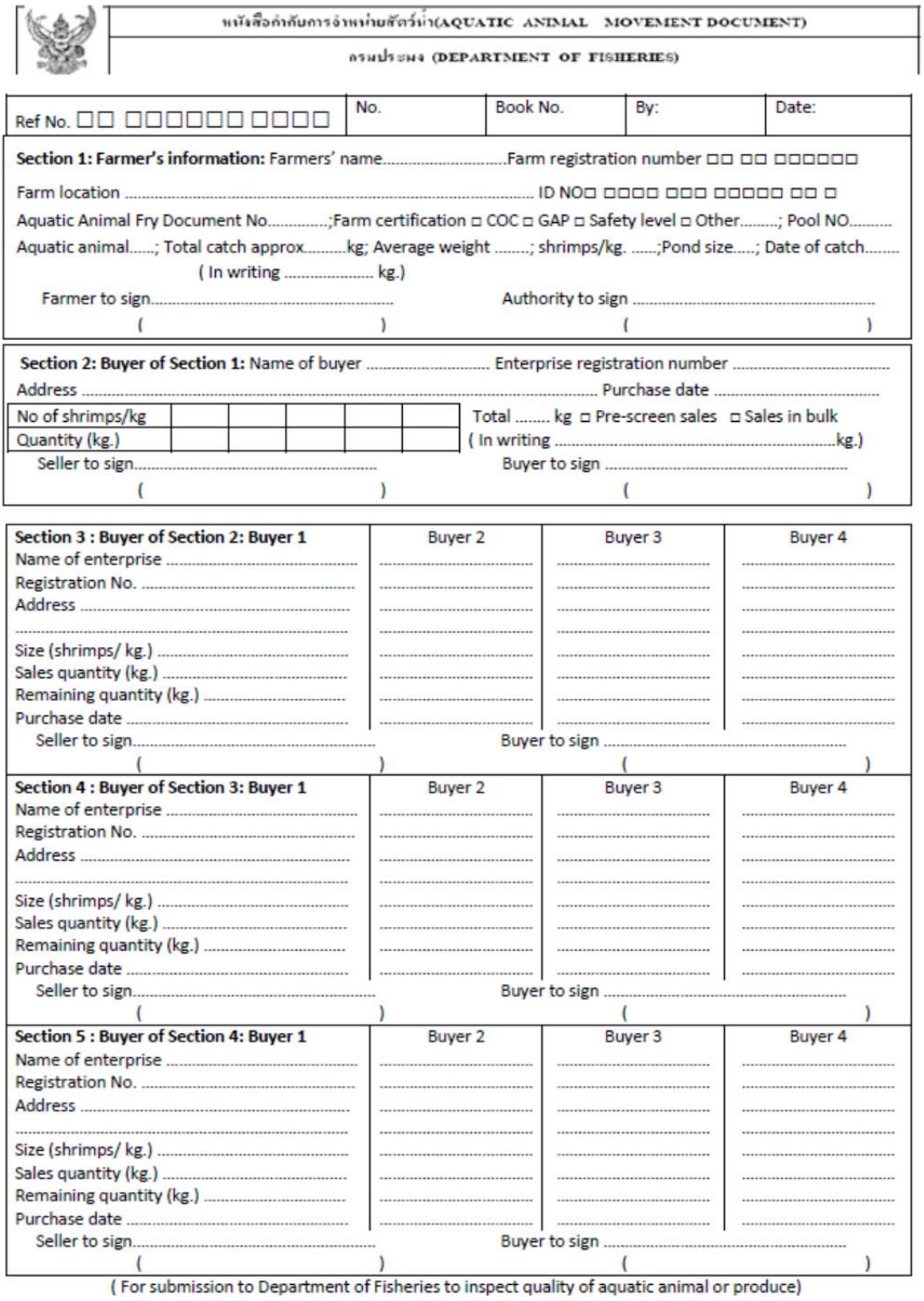
Movement Documents are issued by the DOF. There are two types of MD. One is called the “Aquatic Animal Fry Movement Document (Figure 3)” and is required when farmers purchase fry from input sellers. The other is called the “Aquatic Animal Movement Document (Figure 4)” and is required at each stage of shrimp transactions, from the pond to processors.

As shown in the Figures 3 and 4, the Fry MD shows the details of the seller and buyer of the fry, their ID card numbers, the quantity and date of transaction, and the signatures of the buyer, seller, and the DOF. When farmers and fry sellers agree on a price, they need to go to the DOF and obtain this document. Although a health check of the fry is not required by this document, DOF laboratories provide health tests free of charge. Thus, farmers can be assured that the fry they purchase are free of diseases.

The Aquatic Animal MD shows the details of the farmer who cultured the shrimp, including his/her ID, farm certification, the Aquatic Animal Fry MD Number, the volume, size, and date of harvesting shrimp, and the pond size. The buyer details are also recorded at each stage along the supply chain in which shrimp are transferred to the processor. This MD moves along with the shrimp and is finally submitted to the DOF. Again, detailed analyses of shrimp are not required by the MD, but DOF local offices provide various kinds of analytical services, such as examinations of the health of shrimp, antibiotic tests, and water tests.

This document needs to move along with the shrimp and to be signed by sellers and buyers at each stage. Thus, whenever something happens to shrimp along the supply chain, one can always trace the chain back to the pond level based on the information on the MD. Collectors still mix shrimp from several ponds into a single container and thus it is difficult to spot the precise pond from which a problem arose,

but the system provides some assurance of traceability as well as pressure for farmers to comply with good practices, which may actually be more important than the former, in practice.



หนังสือกำกับการจำหน่ายสัตว์น้ำ(AQUATIC ANIMAL MOVEMENT DOCUMENT)

กรมประมง (DEPARTMENT OF FISHERIES)

Ref No. □□ □□□□□□ □□□□	No.	Book No.	By:	Date:

Section 1: Farmer's information: Farmers' name.....Farm registration number □□ □□ □□□□□□

Farm location ..... ID NO□ □□□□ □□□ □□□□□ □□ □

Aquatic Animal Fry Document No.....;Farm certification □ COC □ GAP □ Safety level □ Other.....; Pool NO.....

Aquatic animal.....; Total catch approx.....kg; Average weight .....; shrimps/kg. .....;Pond size.....; Date of catch.....

(In writing ..... kg.)

Farmer to sign..... Authority to sign .....

( ) ( )

Section 2: Buyer of Section 1: Name of buyer ..... Enterprise registration number .....

Address ..... Purchase date .....

No of shrimps/kg					
Quantity (kg.)					

Total ..... kg □ Pre-screen sales □ Sales in bulk

(In writing .....kg.)

Seller to sign..... Buyer to sign .....

( ) ( )

Section 3 : Buyer of Section 2: Buyer 1	Buyer 2	Buyer 3	Buyer 4
Name of enterprise	.....	.....	.....
Registration No.	.....	.....	.....
Address	.....	.....	.....
.....	.....	.....	.....
Size (shrimps/ kg.)	.....	.....	.....
Sales quantity (kg.)	.....	.....	.....
Remaining quantity (kg.)	.....	.....	.....
Purchase date	.....	.....	.....

Seller to sign..... Buyer to sign .....

( ) ( )

Section 4 : Buyer of Section 3: Buyer 1	Buyer 2	Buyer 3	Buyer 4
Name of enterprise	.....	.....	.....
Registration No.	.....	.....	.....
Address	.....	.....	.....
.....	.....	.....	.....
Size (shrimps/ kg.)	.....	.....	.....
Sales quantity (kg.)	.....	.....	.....
Remaining quantity (kg.)	.....	.....	.....
Purchase date	.....	.....	.....

Seller to sign..... Buyer to sign .....

( ) ( )

Section 5 : Buyer of Section 4: Buyer 1	Buyer 2	Buyer 3	Buyer 4
Name of enterprise	.....	.....	.....
Registration No.	.....	.....	.....
Address	.....	.....	.....
.....	.....	.....	.....
Size (shrimps/ kg.)	.....	.....	.....
Sales quantity (kg.)	.....	.....	.....
Remaining quantity (kg.)	.....	.....	.....
Purchase date	.....	.....	.....

Seller to sign..... Buyer to sign .....

( ) ( )

(For submission to Department of Fisheries to inspect quality of aquatic animal or produce)

Figure 3: Aquatic Animal Movement Document

Source: Department of Fisheries (2016)

แบบ จ.ส.ม.2

หนังสือกำกับการจำหน่ายลูกพันธุ์สัตว์น้ำ

(AQUATIC ANIMAL FRY MOVEMENT DOCUMENT)

กรมประมง (DEPARTMENT OF FISHERIES)

เลขที่ (Ref. No.) ☐☐-☐☐☐-☐☐☐☐☐☐-☐☐☐☐	เล่มที่	เลขที่
ออกโดย (Issued by)	ออกวันที่ (Issued Date)	

รายละเอียดผู้เพาะพันธุ์ (Farmer) :

ชื่อผู้เพาะพันธุ์ (Name)……

เลขที่บัตรประชาชน (ID. Card No.) ☐-☐☐☐☐-☐☐☐☐☐-☐☐-☐

ที่อยู่ผู้เพาะพันธุ์ (Farmer's ddress)……

ทะเบียนฟาร์มเลขที่ (Register No.) ☐☐-☐☐-☐☐☐☐☐☐ มาตรฐานฟาร์ม ☐ CoC ☐ GAP

รหัสเกษตรกร (Farmer ode)……

ที่ตั้งโรงเพาะพันธุ์ (Farm's Address)……

ชื่อสัตว์น้ำ (Common Name of Aquatic Animal)……ระยะ (Stage)……

จำนวนที่จำหน่าย (Numbers of Fry)…… (ตัว, inds.)

ตัวอักษร……

วันที่จำหน่าย (Date of Harvest)……

ลงนามผู้เพาะพันธุ์ (Signature of Farmer)

……

รายละเอียดผู้ซื้อ (Buyer) :

ชื่อผู้ซื้อ (Name)……

เลขที่บัตรประชาชน (ID. Card No.)☐-☐☐☐☐-☐☐☐☐☐-☐☐-☐

ที่อยู่ผู้ซื้อ (Buyer's Address)……

ทะเบียนผู้ประกอบเลขที่ (Register No.)……

จำนวนที่ซื้อ (Numbers of Purchase)……(ตัว, inds.)

ตัวอักษร……

วันที่ซื้อ (Date of Purchase)……

ลงนามผู้ซื้อ (Signature of Buyer)

……

พนักงานเจ้าหน้าที่ (Officer Authority)

……

Figure 4: Aquatic Animal Fry Movement Document

Source: Department of Fisheries (2016)

Certifications: GAP and CoC

When a farmer registers with the DOF, compliance with national certifications of Good Aquaculture Practice (GAP) is a requirement. In Thailand, the National Bureau of Agricultural Commodity and Food Standards (ACFS), Ministry of Agriculture and Cooperatives plays a key role in setting standards for agricultural commodities. ACFS was established in October 2002 under ministerial regulation and is an accreditation body in the area of agricultural commodities. Two types of shrimp-related standards exist in Thailand, the Code of Conduct (CoC) and Good Aquaculture Practices (GAP). While there are many GAPs related to shrimp culture, key production standards are intended for marine shrimp hatcheries (TAS7422-2010) and marine shrimp farms (TAS7401-2009). In each document, details on production practices and inspection methods are explicitly explained. According to an interview with shrimp farmers, the GAP certification is a requirement for farmers to register with the DOF and receive an ID.

The CoC provides environment-focused guidance for sustainable shrimp farming. It started as a certification project supported by the World Bank and was implemented by the DOF beginning in 2000 in collaboration with various private organizations, such as the Thai Shrimp Association and Thai Frozen Foods Association. It began as a code for shrimp farmers, but expanded to cover sellers and processors since 2002. The number of certifiers is up to 160 as of January 2010 (JETRO 2010).

Random checks by the DOF

The DOF conducts regular monitoring of shrimp ponds based on the Sanitary Checklist of Shrimp Farmers, which is based on the guidelines issued by the Codex Standard

Committee. It includes sanitary inspection of shrimp ponds, disease control, tests for the use of veterinary medicines and chemical substances, tests of the feed used, water quality tests, inspection of polluted sludge at the bottom of ponds, quality tests of the water supply and drainage, water quality tests of surrounding communities, chemical residues of shrimp, and so on (JETRO, 2010). These tests are conducted randomly.

In addition to various checks of shrimp ponds, the DOF also controls the inputs. Animal feeds that are used domestically need to be registered with the DOF. The DOF prohibits feed producers from producing feeds that include veterinary medicines and also prohibit the use of chemical substances that are not proven to be harmless to human health. The DOF specifically has the following responsibilities.

- Chemical substances:

  The DOF determines the conditions allowed for purchase, usage, and disposal.

- Labelling and usage instruction:

  The DOF approves of labelling and usage instructions.

- Producers and suppliers:

  All producers and suppliers of veterinary medicines need to be registered with the DOF.

- Imports:

  When importing veterinary medicines for aquaculture usage from abroad, the DOF needs to provide approval.

Table 4: DOF Monitoring Activity on Aquaculture Activities

Item	Target	Frequency
Pond registration		All through a year
Sanitary inspection of ponds	Large-scale Small-scale	2-4 times/ year
Water quality test (BOD, pH, NH_3, PO_4, etc.)		Quarterly
Microorganism (Bacillus coli)	Pond River Sea	Weekly Weekly Quarterly
Chemical substance (PCB, organic chlorine, heavy metal)	River, sea Aquatic products	Quarterly Before shipping
Veterinary medicine residue (oxytetracycline, oxolinic acid, sulfadimethoxine, trimethoprim, etc.)	River shrimp Feed Final products	Quarterly Quarterly Before shipping
Toxin (aflatoxin, etc.)	Aquatic feeds	Monthly
Disease	Shrimps	Monthly
Sanitation of processing factory	Processing factories	Quarterly
Quality assessment	Seafood products	Before shipping
Training (Farmer: GAP, safe usage of veterinary medicine, etc. Processing factories: technical training on the analyses of water quality, micro-organisum, and chemical substances, HACCP, etc.)	Farmers Processing factories	Quarterly

Source: JETRO (2010).

3.3 Active information sharing among various stakeholders

Lastly, probably the most unique and innovative feature of the Thai shrimp sector is the very active information sharing among various stakeholders, including farmers, government officers, experts from academia, and private companies. This information sharing occurs at seminars and workshops, which are often organized in various provinces as well as virtually via online social networking services. The effective linkage between two groups probably enhances the positive effects derived from each

channel. Below, we describe the core actors in this effort.

Thailand Shrimp Association

The Thailand Shrimp Association is an association of shrimp farmers. About 90% of its members are shrimp farmers, and the rest include processors and a few hatcheries. Its activities are supported by contributions from the members only. In each province, there are several so-called “shrimp clubs” and these local shrimp clubs are members of the Thailand Shrimp Association. Their main activity is to hold seminars to share information about market price, conditions, and technical issues to cope with problems faced by farmers. It is important that these clubs operate mainly to share information and ideas and not to market their products together, as is often done by agricultural cooperatives. The shrimp clubs are purely information-acquisition devices for farmers.

Thailand Frozen Foods Association

The Thailand Frozen Foods Association (TFFA) is a non-profit organization founded in 1968; it has about 200 members, who are mostly frozen food processing and exporting companies, especially seafood products. To export frozen food, a company needs to be a member of TFFA. The Ministry of Commerce requires registration with TFFA, which issues a health certificate that is necessary for exporting goods. In addition, TFFA offers and participates in seminars to share market information and plays an important role in raising awareness of farmers on the non-use of antibiotics. One member of TFFA mentioned that “long ago, the use of antibiotics was a problem in Thailand, but everyone including TFFA was involved in changing the behavior. Probably the maturity of shrimp farmers in Thailand is an advantage relative to other countries. We have more

experience in this business and know that if we keep using antibiotics in shrimp culture, we just cannot sell. It is a serious business."

Seminars and SNS

In the Thai shrimp community, regional seminars are held very frequently, as often as once per month in some provinces. In regional seminars, technical training is offered by academic experts, governmental officers, and private companies. In addition, sometimes farmers themselves develop new ideas to deal with diseases or other problems during culture and share their findings with seminar participants.

In addition to these monthly seminars, it is notable to point out that virtual networks via social networking services (SNSs), such as Facebook and Line, function as very important devices for the shrimp farming community in Thailand. According to interviews, one Facebook group of Thailand shrimp farmers has over 5,000 members, who are constantly sharing their experiences related to shrimp farming. The information shared are market prices, climatic information, how to prepare for such climates, how to prevent diseases, how to deal with shrimp diseases, and so on. As shrimp are very delicate aquatic animals whose health conditions change very quickly after a problem occurs, appropriate and instant information is vital for shrimp farmers. By using SNS effectively, farmers can ask questions, upload photos of their shrimp for diagnosis, and receive immediate answers from fellow shrimp farmers or academic experts. According to one university professor, "It is good to use SNS to share information, but it is also important to include someone who knows technical details well so that when the discussion goes in the wrong direction, it can be corrected. In the Thailand shrimp community, many stakeholders are involved and we are always having lively

discussions.” Indeed, farmers upload photos of their shrimp ponds or shrimp to ask for advices on the Facebook page and they do not hesitate to share their own practices or experiences. One successful farmer even shared data regarding his shrimp culture online. It seems that this very active sharing of information among farmers was a key to changing the practices of farmers in Thailand.

Private Companies

Large private companies also offer assistance to smallholders. In Thailand, there are only two so-called “four-star” companies, which own a processing factory, hatcheries, grow-out ponds, and feeding mills. These are the Charoen Pokphand (CP) group and Thai Union Foods. Although they have their own ponds, the processing capacity far exceeds the amount of shrimp they can produce; accordingly, they also rely on numerous smallholders. They educate these smallholders by offering technical or market information, particularly on diagnostics services. Goss et al. (2000) mentioned that by providing these services to independent farmers free of charge, these companies also gain; they obtain active knowledge of the farming systems in the area (such as the size of the potential harvest and prevalence of disease), which is important to plan processing and marketing abroad, and they obtain the trust of smallholders to maintain a firm relationship for shrimp purchases. In the past, there have been attempts to formally establish contracts between these processors and smallholders, but these attempts were unsuccessful because farmers were opposed to fixed price systems (Goss et al., 2000). General social networks that disseminate technical and market information appear to work best in this business environment.

To sum up, at least three factors contributed to the successful transformation of production practices in Thailand: 1) access to public laboratories for shrimp diagnosis, 2) various efforts by the government to control and regulate smallholder production, and 3) very active information-sharing among various stakeholders within the sector. Accordingly, smallholders are not only regulated (via punishment) by the government, but are also provided many practical tools to improve their production. Although farmers are not rewarded with higher than market prices, they have enough incentives to change their production practices. This experience in Thailand should be a reference for other shrimp-producing countries.

4. Consumer Awareness in Vietnam[1]

As domestic consumer awareness contributes to improvements in the quality of food via the market, it is also of interest to study how consumers view food safety in these countries. Thus, we conducted a survey of consumers in Vietnam to examine questions such as whether they rely on food labelling when they make purchases, how much they are willing to pay for these commodities, and whether consciousness about food safety differs between Hanoi and Ho Chi Minh City, in which the local economy has a longer history of market mechanisms.

4.1 Survey Site and Data Collection

The survey was conducted in collaboration with the Institute of Vietnamese Studies and

[1] This section owes much to the cooperation of Prof. Vu Kim Chi, Institute of Vietnamese Studies and Development Science, Vietnam National University, and Yuta Sasaki, University of Tokyo.

Development Science, Vietnam National University at the premises of a Japanese supermarket, AEON, in Hanoi and Ho Chi Minh City in January 2016. To obtain consistent samples, surveys in each city were conducted on the same days of the week (Friday, Sunday, and Monday). We chose customers randomly and asked them to fill in a questionnaire written in Vietnamese with the support of enumerators. We obtained 100 respondents in Hanoi and 101 respondents in HCMC. The questionnaire included questions on their knowledge and perception of VietGAP, consciousness about health and food purchases, and those related to their willingness-to-pay (WTP) for safe food, as well as socio-economic characteristics. VietGAP is a national certification issued by the Ministry of Agriculture and Rural Development since 2008 that guarantees safe and clean production methods. The VietGAP label is given to products that are produced under this method.

4.2 Descriptive Results

Table 5 shows the descriptive statistics for the respondents in two cities. The respondents were not very different. Table 6 summarizes the knowledge level and perception of VietGAP products in the two cities. As expected, the knowledge index was lower in Hanoi than in HCMC for all aspects. We observed the same tendency for respondent perceptions. These data suggest that consumers in a city with a more recently established market mechanism (such as Hanoi) have less knowledge about and trust in third-party certifications such as the VietGAP.

Table 5: Summary Statistics of Respondents

	HCMC (101)		Hanoi (100)	
	Mean	S.D.	Mean	S.D.
Gender	0.28	0.45	0.33	0.47
married or not	0.48	0.49	0.9	0.30
children under 11	0.21	0.41	0.61	0.48
Age	35.50	13.31	37.42	10.36
highest degree of education	3.90	1.89	3.8	1.69
highest degree of education of mother	2.55	1.74	2.68	1.92
breadwinner or not	0.45	0.49	0.54	0.49
born in this city or not	0.50	0.50	0.72	0.44
main place to buy vegetable	1.33	0.63	1.76	0.61
main place to buy safe vegetable	1.11	0.45	1.88	0.96
nearest supermarket	1.91	0.82	2.02	0.64
nearest market	1.55	0.71	1.56	0.66
nearest vegetable shop	1.77	0.74	1.98	0.73
familiar vegetable shop	0.63	0.48	0.65	0.47
household income	1.71	0.81	1.64	0.74
current job situation	0.80	0.39	0.83	0.37
job type	2.90	2.04	2.65	1.67

Source: IDE-VNU/IVIDES Survey (2016)

Table 6: Knowledge and Perceptions about VietGAP

	HCMC		Hanoi	
	Mean	S.D.	Mean	S.D.
Knowledge				
Do you know VietGAP	3.00	0.98	2.94	0.99
Have you ever buy VietGAP food?	3.31	1.11	3.15	1.11
Did you know that VietGAP food basically means the non-use of prohibited chemicals and fertilizers for production periods?	3.25	0.92	3.15	0.90
Total Points	9.62	2.60	9.23	2.66
Perceptions				
I believe that VietGAP vegetable is safer than conventional vegetable.	3.85	0.40	3.33	0.86
I have a great trust in the standards behind the VietGAP.	3.87	0.36	3.21	0.89
I have a great trust in the inspection system behind the VietGAP.	3.84	0.41	3.13	0.95
Total Points	11.49	1.37	9.69	2.48

Source: IDE-VNU/IVIDES Survey (2016)

Table 7 shows perceptions regarding safe vegetables and vegetable shops. With respect to perceptions of safe vegetables, consumers in the two cities did not differ substantially. They both cared about the safety of vegetables and the consequences of consuming safe vegetables. However, with respect to perceptions of vegetable shops, it was interesting that trust for a familiar shop was much higher in Hanoi than HCMC. This may be explained by the longer market history in HCMC; consumers do not have personal opinions about shops in general, while in Hanoi, close relationships between consumers and sellers have been the norm for many years and thus people care about their relationship with suppliers.

Table 7: Perceptions about Safe Vegetables and Vegetable Shops

	HCMC		Hanoi	
	Mean	S.D.	Mean	S.D.
Perception about safe vegetable				
I can have substantial positive impact on my health by purchasing certain kind of products	2.30	1.16	2.81	1.20
I believe safe vegetable is good for my health.	3.86	0.50	3.71	0.65
I believe safe vegetable have higher quality than conventional vegetable	3.85	0.53	3.81	0.54
Total Points	10.02	1.61	10.32	1.64
Perception about vegetable shops				
I believe that the vegetable sold at the familiar shop I always go to buy safe vegetable is safer than conventional vegetable.	3.29	0.80	3.42	0.80
I trust the quality of safe food sold at the familiar shop	3.15	0.79	3.4	0.76
I trust the quality inspection of the familiar shop I always buy a safe food.	3.28	0.83	3.46	0.78
Total Points	9.73	2.10	10.31	2.12

Source: IDE-VNU/IVIDES Survey (2016)

Lastly, Table 8 describes the WTP for VietGap vegetables as well as vegetables sold at familiar shops. As expected, the WTP for VietGap products was higher in HCMC than in Hanoi. Similarly, the WTP at familiar shops was higher in Hanoi than in HCMC. These results confirm the findings summarized in the previous tables.

Table 8: WTP for VietGAP Products and Familiar Shop

	HCMC		Hanoi	
	Mean	S.D.	Mean	S.D.
WTP for VietGAP vegetable	28,950.5	7,051.6	27,580	6,696.0
WTP for familiar shop vegetable	25,861.3	4,893.7	33,880	10,496.6

Source: IDE-VNU/IVIDES Survey (2016)

Based on these results, consumer awareness of safe food and perceptions about third-party certification differs among consumers in the two cities. Although more rigorous analyses are required to make precise conclusions, different policies appear to be necessary to increase consumer awareness depending on norms in the area. HCMC, in which the market mechanism has been operating for longer, consumers seem to trust the third-party certification more than in Hanoi, in which arm's length market transactions are more common and consumers seem to trust their personal network with the shops. In the latter case, promoting a third-party certification may not be highly effective.

5. Conclusion

We examined food quality control from two perspectives, that of the producer and that of the consumer. In the former case, we examined how so-called good practices can be adopted and widely accepted, taking the Thailand shrimp sector as a case study. In the latter case, we examined Vietnamese consumer awareness. In Thailand, the public sector played several important roles in providing access to public laboratories, requiring registration with the government and Movement Documents for traceability, and requiring GAP certification. The private sector also plays an important role in information dissemination and provides technical knowledge. Farmers themselves also actively share their own experiences with others. In a study of Vietnamese consumers, we observed a difference in food safety awareness and the trust of third-party labelling between two cities that have different experience levels with the market mechanism. Accordingly, these cities may benefit from different policies to raise quality awareness towards food commodities among consumers.

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