Chapter 8

Marketing Risks and Standards

Compliance: Challenges in Accessing the Global Market for High-Value Agricultural and Aquacultural Industries

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Export-oriented, high-value agricultural and aquacultural industries are among the first industries that many developing countries target to catalyze economic development (Jaffee and Morton 1995; World Bank 2008; FAO 2012; Birthal et al. 2015). Typically less capital- or skill-intensive than the manufacturing industry, these industries can also involve smallholders or small-scale farmers and help in reducing poverty. Availability of agricultural land, favorable climate, and inexpensive labor in these countries adds to their comparative advantage in production. Therefore, it is not surprising that the export of high-value crops produced in developing countries has been increasing in volume over time (Jaffee 2003; Weinberger and Lumpkin 2007; Reardon et al. 2009).

Several studies show that these export-oriented industries are increasing the income of the participants (Maertens et al. 2012; Briones 2015; Suzuki et al. 2018). Participating in export markets is also found to have positive effects on: adopting advanced technology or better practices; improving working environment and product quality; and increasing employment opportunities (Neven et al. 2009). The reduction of trade tariffs, the advancement of transportation technology, and development of online markets facilitate the growth of these sectors in the background.

While global markets offer a greater demand and higher prices to producers in developing countries, they also have several distinct features that do not hold in the domestic markets of developing countries. These include large price fluctuations, intensive competition, sudden changes in trade policies (e.g., preferential agreements) and regulations (e.g., quality standards, certifications, and labor or environmental standards), and shifts in demand trends (Maertens and Swinnen 2009; Hansen and Trifkovic 2014). These are proving to be barriers for developing country

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producers to access global markets, and it is necessary to overcome these barriers to continuously benefit from the global markets. Consequently, it is important to understand how these demanding international markets requirements are affecting producers in developing countries. What are the challenges posed by global markets and how are producers dealing with them? Are there ways to overcome the challenges?

In order to answer these questions, this chapter focuses on two challenges for producers in developing countries posed by the global markets—marketing risks and the difficulty of standard compliance. These are some of the factors that producers need to face and successfully overcome in order to participate in global markets. We illustrate the importance of these factors by using cases from two export-oriented industries—the pineapple industry and the shrimp aquaculture industry. For each industry, we describe a case where a country is unable to surmount these challenges and another case where a country has successfully overcome them. The cases are drawn from Ghana, Vietnam, and Thailand.

The rest of this chapter is structured as follows. Section 8.1 discusses the significance of marketing risks for producers in developing countries and how they are being mitigated by pineapple-exporting industries in Ghana and Thailand. Section 8.2 explores the challenge of standards compliance posed by the global markets and the different response of the shrimp aquaculture industries in Vietnam and Thailand. Section 8.3 presents the conclusion.

8.1 Marketing Risks: Pineapple Exporting Industry in Ghana and Thailand

We examine two types of marketing risks in this section—the risk of having unsold crops and that of a sudden change in demand. Export-oriented commodities typically have limited domestic demand in developing countries. Thus, when farmers who produce these crops cannot export them, they will be left with unsold stock. It represents considerable sunk cost in terms of inputs, labor, and land. The risk of unsold produce may restrain farmers from participating in the export market. Typically, the farmers who participate in the export market are relatively well-off and can absorb these risks; thus, the income gap between the poor and non-poor has been widening due to the difference in their risk-taking ability. Further, the global market demand may change suddenly as new types or varieties of crops are developed. These changes act as exogenous shocks for the producers in developing countries and unless they adopt these new varieties, they fail to continuously benefit from the global market. In the next sub-section, we examine the importance of these marketing risks in the pineapple industry in Ghana and compare it with the situation existing in the Thai pineapple industry.

Fig. 8.1 Structure of the pineapple sector in Ghana. *Source* Illustrated by authors

8.1.1 Pineapple Industry in Ghana

8.1.1.1 Overview

The first case examined is the pineapple export industry of Ghana. Like other African countries, Ghana has been trying to diversify its economy and reduce its reliance on the traditionally important mining and cocoa industries. The pineapple export industry has been showing promise since the 1980s and its share in the export volume has increased over the years. Fresh fruit for export is mainly targeted at the EU market. The industry has also received attention for its potential to reduce poverty. This is because small-scale pineapple farmers can become involved in this supply chain by producing fruit on their farm and selling to the exporters (Danielou and Ravry 2005; Fold and Gough 2008; Barrett et al. 2010).

The structure of this industry has evolved over some years. Initially, pineapples were produced only by small-scale farmers. As the business expanded, factors such as a larger volume of production, quality of fruit, timing of the harvest, and consistency in supply became more important. This induced many exporters to establish large-scale plantation farms to produce fruit in-house. However, almost all the exporters continue to procure a part of their export volume from smallholders, and this ‘core–satellite system’ of production organization—or partial vertical integration—has become the dominant mode today (Fig. 8.1).

While this industry continues to grow, the importance of sales risks in it are also discussed (Fold and Gough 2008; Suzuki et al. 2011). One of them is the risk of unsold fruit and the other is the shift in demand, as explained below.

8.1.1.2 Risk of Unsold Fruit

In adopting pineapple production in Ghana, the largest risk for farmers is probably that of unsold fruit after harvesting. To sell for export, farmers need to sell fruit to exporters who come to their fields to purchase it. There are no middlemen between the exporters and the farmers due to the perishability of fruit and the need for extensive coordination. If farmers cannot sell to exporters, they are left with unsold fruit.¹ The planting to harvesting cycle for pineapples is fourteen months long. As the opportunity cost of land is very high, fruit remaining unsold has serious economic consequences. Two important factors contribute to the risk of unsold fruit: the perishability of horticultural crops and the limited extent of the domestic market. The shelf life of horticultural crops is generally short; thus, the produce needs to be sold immediately after harvesting. Given these conditions, farmers are left with less time to find potential buyers, which may negatively affect their bargaining power when negotiating with buyers.

While this is also a factor in developed countries, an additional factor that enhances risk in developing countries is the limited ability of the domestic market to absorb the unsold horticultural produce due to the limited domestic demand for fresh produce and an underdeveloped processing industry. Generally, food processing is capital intensive, and thus, the initial cost of starting a processing factory is high. This is particularly so in countries where the industrial sector is still largely underdeveloped due to the fact that it cannot benefit from low input costs (i.e., cost of input materials and labor) that are often made possible by the existence of industrial clusters (Sonobe and Otsuka 2011). Further, inadequate government support often compels private companies to invest in the infrastructure necessary to set up their factories—extending the existing roads and connecting to the water supply system and electricity grid—themselves. Because the demand from the processing industry and domestic market is limited, the perishability of horticultural crops translates into a large risk for farmers in developing countries.

In fact, Suzuki et al. (2011) showed that one of the reasons the smallholders are able to continuously participate in the export industry as producers of pineapples is the fluctuating demand in EU and the limited domestic outlets to sell pineapples. Because the demand from EU for pineapples fluctuates, the exporters first satisfy a certain portion of the expected demand from their internal production and use the external smallholders' produce to fill the gap between the actual and the expected demand. This mechanism is consistent with the partial vertical integration theory by Carlton (1979). Suzuki et al. (2011) used the rejection rates by exporters during purchase of the fruit grown on smallholders' plots to examine whether it is related to the degree of fluctuation in demand from the EU. The estimation results showed that when the unanticipated portion of demand from the EU for Ghanaian pineapple is positive, the exporters reject less fruit from smallholders. Although their study does

¹Domestic markets for fresh produce exist, but the variety preferred in the domestic market is different from the export variety in Ghana.

not exclude other reasons, such as the difficulty in accessing land to open large-scale farms, their result provides evidence that demand risk is one of the factors that enable smallholders to play a role in this industry.

8.1.1.3 Risk of Demand Shift: MD2

Another marketing risk for the pineapple producers in Ghana posed by the global markets was the shift in the variety of pineapples demanded in EU. The move, led by the multinationals, drastically affected the stakeholders involved in this chain. The new variety, MD2, was originally developed by the Hawaii Pineapple Research Institute and further modified by Del Monte in their plantation farms in Costa Rica (Fold and Gough 2008). MD2 is sweeter, smaller in size, more yellowish in appearance, and more consistent in flavor than the traditional variety called Smooth Cayenne. However, it requires many more chemical inputs and greater care during production than Smooth Cayenne (i.e., it is more capital- and labor-intensive).

With this change, the Ghanaian exporters suddenly lost market share in the EU market. They could not find outlets to sell their fresh Smooth Cayenne. Although many exporters wished to switch to the new variety, the transition was not smooth because of factors such as the very high initial investment costs for MD2, starkly different production practices, and the time required for the new variety to adjust to the Ghanaian climate and soil. Small-scale farmers were also hit hard (Fold 2008; Fold and Gough 2008). Those who had sold to exporters who went bankrupt could not receive payment, and even the exporters who survived the change owed a large amount to the smallholders (Fold 2008; Fold and Gough 2008; Barrett et al. 2010).

Suzuki (2016) examined whether this change in the demand affected the survival behavior of pineapple producers. Figure 8.2 shows the hazard estimates for pineapple producers, categorizing the farmers based on the period in which the production span of the crop falls. Phase 1 includes production spans that are exclusively in the pre-MD2 period; Phase 2 includes production spans that begin in the pre-MD2 period and end in the post-MD2 period, while the span in Phase 3 is entirely in the post-MD2 period. The figure shows that the hazard estimates for Phase 2 is far higher than that for the other two groups, indicating that during this period, the probability of exit was very high for farmers. The hazard for Phase 3 is also higher than that for Phase 1, suggesting that after the MD2 shock, the likelihood of exiting the pineapple production was more than that in the pre-MD2 period.

A similar analysis was conducted to separate the hazard for those with a risk aversion index value between 1 and 3 (less risk averse; RA index = 0) from those whose risk aversion value was between 4 and 6 (more risk averse; RA index = 1) (Fig. 8.3). This indicates that those with a higher risk aversion index face higher hazard estimates. That is, the probability of exiting the pineapple production is higher for more risk-averse individuals than for less risk-averse individuals.

As these figures are from non-parametric analyses, without controlling for other heterogeneities across observations, Table 8.1 shows the hazard ratios of exit that are estimated using semi-parametric model (column (1)) and parametric models

Fig. 8.2 Hazard estimates by production-span groups (nonparametric analysis).
Note Phase 1 indicates production span that starts and ends in pre-MD2 period; Phase 2 indicates that it starts in pre-MD2 and ends in post-MD2 period; Phase 3 indicates that it starts and ends in post-MD2 period

Fig. 8.3 Hazard estimates by risk-averse index (nonparametric analysis).
Note RA index = 1 indicates that farmers are more risk-averse (RA index between 4 and 6) while RA index = 0 indicates that farmers are less risk-averse (RA index between 1 and 3)

(columns (2) and (3)).² First, the risk preferences are found to matter for the likelihood of exiting the pineapple production and the results are consistent across all these models. Second, the Phase 2 dummy (the production span begins before the MD2 event and goes beyond it) and the Phase 3 dummy (the span starts after the MD2 incident) are also statistically significant and higher than one. The coefficient on the Phase 3 dummy is also in the similar magnitude of Phase 2 but lower than that of Phase 2. This means that the likelihood of exiting pineapple production is significantly higher in the post-MD2 period than in the pre-MD2 period, confirming the serious effect that the MD2 event had on farmers' behavior in Ghana. Models using other functional forms also provide similar results.

²Note that the numbers reported in these tables are hazard ratios. Thus, if the number is higher than one and statistically significant, then the risk of exit is higher for the corresponding independent variable.

Table 8.1 Determinants of hazard to exit from the pineapple market

	Cox proportional	Weibull	Gompertz
	(1)	(2)	(3)
<i>Individual characteristics</i>			
Risk aversion (RA)	1.17*** (2.71)	1.16*** (2.68)	1.17*** (2.74)
Phase 2 dummy	4.66*** (5.14)	4.70*** (5.18)	4.53*** (5.17)
Phase 3 dummy	4.11*** (3.91)	4.40*** (4.06)	3.78*** (3.88)
Age	0.97** (2.34)	0.97** (2.27)	0.97** (2.37)
=1 if male	0.47** (2.11)	0.48** (1.99)	0.48** (2.15)
Years of schooling	1.00 (0.11)	1.01 (0.19)	1.01 (0.18)
Size of household	1.07 (1.44)	1.07 (1.39)	1.07 (1.33)
Household asset	1.00* (1.76)	1.00* (1.80)	1.00* (1.75)
=1 if received Best Farmer Award	0.98 (0.06)	1.00 (0.01)	1.03 (0.07)
=1 if reentry	0.30** (2.45)	0.30** (2.46)	0.28*** (2.65)
<i>Village characteristics</i>			
=1 if by road	0.44*** (3.38)	0.42*** (3.51)	0.44*** (3.38)
Years of exporters' visit	1.03 (1.05)	1.03 (1.02)	1.02 (0.86)
Years of pineapple production	0.97** (2.28)	0.97** (2.21)	0.96** (2.33)
R2_P	0.09		
N	209	209	209
Chi2	90.72	84.50	92.62

Note *indicates significance at a 10% level, **at a 5% level, and ***at a 1% level. Reported numbers are hazard ratios. All include district fixed effects. Standard errors clustered at the farmer level are reported in the parentheses. Covariates are evaluated at 2007

8.1.1.4 Summary: Pineapple Industry in Ghana

The analyses above showed that marketing risks (having unsold fruit and sudden change in the demand) are significant in the pineapple exporting industry in Ghana; that risk preferences matter in the survival as pineapple producers; and the probability of farmers exiting the pineapple production became higher after the MD2 incident. These present a hurdle for the smallholders to participate in the supply chain, and consequently only the relatively better-off farmers are able to participate and benefit from the greater demand and higher prices in the global markets. This leads to an increase in the income gap among the farmers within communities. Are there ways to reduce these negative effects and involve more smallholders in this chain? We next examine the case of the pineapple industry in Thailand.

8.1.2 Pineapple Industry in Thailand

8.1.2.1 Overview

The most important difference between the pineapple industries in Ghana and in Thailand is the large share of fruit produced by small-scale farmers in the latter. In Thailand, it is reported that 95% of the pineapple production is from the smallholders (about 30% in Ghana), and the contract farming is a popular mechanism to involve smallholders in the supply chain (Hayami et al. 1990; Anupunt et al. 2000). This fact raises a question as to why smallholders in Thailand succeeded in securing a dominant role in supplying pineapples for the export market. What are the fundamental differences between the pineapple production and marketing in Thailand and those in Ghana? What have been the impacts of participating in pineapple production on these smallholders? In fact, in many pineapple producing countries, the fruit are produced on large-plantation farms, most notably in Latin America and the Philippines. However, the role of smallholders is very large in Thailand. We explore how it has come about in this section.

8.1.2.2 Role of Processing Industry in Reducing Risk

One important difference between the pineapple industries in Ghana and Thailand is that while the former focuses on fresh fruit export, the latter focuses on the processed fruit export. The market risks, which we have seen in the case of Ghana, are much reduced in Thailand because of the extent to which the processing industry has developed.

Although smallholders wish to sell their entire produce to the local fresh fruit market due to its high price, local fresh market outlets is limited both in volume and in access and requires higher quality. Figure 8.4 presents the structure of this industry in Thailand. Thus, the second option for smallholders is the processed market. They can

Fig. 8.4 Structure of the pineapple sector in Thailand. *Source* Illustrated by authors

either sell directly to factories, village collectors, or to agricultural cooperatives. Only the relatively large smallholders can sell directly to processors as the processors have minimum purchase volume requirement and control the supply of fruit by offering quotas to the sellers.

Those smallholders who cannot sell directly to processors sell fruit to collectors or to agricultural cooperatives in villages. The collectors have stores (usually just a space with shade) in villages. They purchase pineapples from smallholders, and sell the fruit to processing factories. They announce daily purchase price at the store, just as in gasoline stations, and the price fluctuates every day. Normally these collectors purchase all the fruit brought by smallholders, irrespective of quality and quantity. When the fruit is brought in, they grade the fruit into two separate baskets—qualified and unqualified. The qualified fruit is offered a higher price while the unqualified fruit is offered a lower price but is still purchased. As collectors do not set the minimum volume for purchase, farmers are able to bring fruit even in small quantities. For these small-scale farmers, the village collectors play a crucial role in reducing the marketing risks and in connecting them to the global pineapple supply chain. Because the farmers are guaranteed the sale of their fruit, they can safely invest their time and money in producing pineapples. The village collectors are also providing these farmers a way to obtain cash when they need.

Once the collector's pickup is filled with enough fruit, they bring the qualified ones to factories. The unqualified fruit is peeled and cut into slices of several sizes manually. They sell the slices to juice or jam factories, while the peeled skins are sold as cattle feed. Because there are various types of processed pineapple products

in the market, such as pineapple paste, jam, juice, and biscuits, no part of pineapple is wasted once it is brought to the collectors. The variety of products available helps in diversifying the risks of producing unqualified fruit and absorbing the fluctuation in demand of different markets. In each market, there are different actors involved, such as jam processors, juice processors, and cattle feed traders. This highly sophisticated division of labor contributes in improving the total competitiveness of this industry.

8.1.2.3 Summary: Pineapple Industry in Thailand

The pineapple industry in Thailand presents a case where the smallholders are able to play an important role as producers. The processing industry surrounding the pineapple production is well developed, and thus, the risk of having unsold fruit is minimum in Thailand. Collectors play an important role in selecting the destination of the fruit based on its quality and they have multiple outlets to sell the fruit. From the smallholders' point of view, any well-produced pineapple can be sold, and thus, they do not face barriers to participate in the supply chain for exported pineapples. As collectors purchase fruit in small quantities, farmers do not need to have large farms. The prices offered by them are lower than those obtained by selling in the fresh fruit market, but the structure of this industry has an advantage to enable involvement of a greater number of smallholders. Those who are relatively well-off are able to sell at the fresh fruit market and earn higher prices. Low market risks, which were made possible with the development of the processing industry, seem to be the key reason why the smallholders have a 95% share of the pineapple production in Thailand. It presents a model of high-value agricultural industries in developing countries that is worth emulating.

8.2 Standards Compliance: Export Shrimp Aquaculture in Vietnam and Thailand³

The second challenge facing producers in developing countries that we examine in this chapter is the difficulty in standards compliance. As mentioned in the introduction, the number of quality standards or certifications required to compete in the global market is on the rise. These requirements were initially only related to food quality, and were later made stricter due to the food scare incidents in developed countries. However, the aspects covered by these requirements soon expanded to include environment protection and social ethics (Suzuki and Nam 2013). Examples include the GLOBALGAP, ISOs, HACCAPs, BRCs, Rainforest Alliance, Marine Steward-

³This section draws largely from Suzuki and Nam (2016) and Suzuki and Nam (2018).

ship Council, and so on. While these standards and certifications are designed for the noble purpose of ensuring superior food quality, ensuring decent labor conditions, or environmental protection, they are causing a lot of challenges for the producers in developing countries. To illustrate this, we take a case of the shrimp aquaculture industry in Vietnam and Thailand in this section.

8.2.1 *Shrimp Industry in Vietnam*

8.2.1.1 Overview

Seafood export has become one of the major export products from Vietnam and the shrimp exports is one of the fastest growing segments in the seafood products industry. In Vietnam, as well as in many other Asian countries, the major shrimp producers are smallholders. Thus, the industry is seen to contribute to the reduction of poverty and boosting income of rural farmers.

However, the industry is also facing a challenge of a high port rejection rate, which is the percentage of exports rejected at the ports of developed countries. According to the UNIDO-IDE (2013), the seafood products from Vietnam are facing a high port rejection rate, and consequently, the importing countries are raising the frequency of inspection for Vietnamese products. This is not only adding the inspection costs for the processors, but also worsening the reputation of the country as a shrimp exporter, which can potentially threaten the future of this industry. In fact, using the US port rejection data, Jouanjean (2012) and Jouanjean et al. (2015) show that such incidents damage reputation and credibility of exporting countries and have negative effects on trade.

In Vietnam, the main producers of shrimp are smallholders and this makes it very difficult to control farming practices at the producers' level. Tran et al. (2013) also discusses this upstream "fragmentation," which has negative effects in complying with standards. Although some processing companies have their own ponds to produce shrimp in-house, the amount that can be cultivated within their own ponds reaches only about 20% of their maximum processing capacity. Thus, processors rely on outside purchases, and this is commonly done through collectors.⁴ Collectors reside in communes near the production area and purchase from neighboring smallholders. As each farmer's pond is too small to fill a container, they mix shrimp purchased from different farmers into a single container that is sent to the processor. According to Loc (2006), about 60% of shrimp are sold to processing companies through collectors and/or wholesale buyers. This system makes it difficult to trace the pond of origin.

⁴While there are also contracted farmers, who sell directly to processing companies, their number is limited as this direct sale typically requires a large volume of shrimp.

8.2.1.2 High Port Rejection Rates

According to the UNIDO-IDE (2013), Vietnam's rate of import rejections for fish and fishery products is high for all years between 2006 and 2010, relative to other countries. When we examine the reasons reported for these rejections, veterinary drug residues rank first, followed by bacterial contamination. The detected veterinary drug residues must originate in the production stage, as these residues are found within fish bodies and fishery products. Bacterial contamination can occur even after the production stage, during the transportation by ship from Vietnam to Japan, for example. We can infer that the major reasons behind the high rejection rate of Vietnamese exports occur at the producers' level. This is an important finding in terms of considering how to solve the problem of port rejection. In fact, from field observations, shrimp farmers in Vietnam use veterinary drugs (e.g., antibiotics) to prevent and treat shrimp diseases although some of these antibiotics are prohibited. It seems that the most effective solution is to change farming practices at the producer level.

8.2.1.3 Better Management Practice and Disease Outbreak

As the intensive shrimp aquaculture is known to cause a deterioration of the surroundings if not practiced properly, international organizations have published guidelines on shrimp farming. The FAO issued the Code of Conduct for Responsible Fisheries in 1995. Then, to provide a specific code of conduct for the shrimp industry, an international consortium was established in 1999, involving organizations such as the World Bank, the Network of Aquaculture Centres in Asia-Pacific (NACA), the World Wildlife Fund, and FAO. There were a series of discussions and meetings among stakeholders for many years, which led to the International Principles for Responsible Shrimp Farming (FAO et al. 2006) being issued in 2006. This document lists the basic principles that should be followed during shrimp farming. In Vietnam, to support these international principles and standards, the NACA and the Directorate of Fisheries, Ministry of Agriculture and Rural Development of Vietnam, in collaboration with a Danish aid organization, launched a project to promote responsible shrimp farming and developed the Better Management Practices (BMPs) (Corsin et al. 2008). These BMPs were very simple to adopt and were disseminated across the country (Corsin et al. 2007).⁵

However, the port rejection data, as well as our own fieldwork, indicate that these BMPs are not being fully implemented. Most farmers do not know about the substances that are banned in the international markets and the composition of the inputs they use. Thus, to examine the determinants of BMP adoption and whether BMPs actually lower the probability of disease outbreak, Suzuki and Nam (2018)

⁵Examples of the BMPs include: preparing a pond properly, removing waste soil from the bottom of the pond before stocking, having a reservoir pond to replace water during culture (Corsin et al. 2008).

conducted a survey of shrimp farmers in one district in Camau Province in southern Vietnam in 2015.

Table 8.2 presents the results of the determinants of BMP adoption, which is reproduced from Suzuki and Nam (2018). They find that belonging to a cooperative has a positive effect on adoption of BMPs, while having siblings who cultivate shrimp has a negative effect. The latter finding suggests that farmers who learn shrimp farming from their family or siblings are more traditional and are less likely to adopt practices recommended by the international organizations. It also shows that the types and number of information sources influence the adoption of BMPs. Furthermore, past experience of receiving technical training also positively affects BMP adoption, confirming the effectiveness of promoting the adoption of BMPs.

Table 8.3 shows the results of propensity score matching for the impact of BMP adoption on disease outbreak based on the Kernel matching which yielded the least bias among several matching methods that we have tried. Column (1) shows that if farmers adopt four or more practices out of the five, the probability of their farms having a shrimp disease outbreak is reduced by 39%. This finding is statistically significant at the 1% level. If farmers adopt three or more BMPs, then the probability of their shrimp having disease will be reduced by 21.1%. When farmers use two or more BMPs, the impact on disease outbreak is no longer statistically significant. These findings support that BMP adoption indeed results in farmers facing fewer outbreaks of shrimp disease.

8.2.1.4 Summary: Shrimp Industry in Vietnam

This section showed that the difficulty of standards compliance in the shrimp industry in Vietnam lies in the fact that the main actors are numerous smallholders. While the efforts are made by the government to disseminate technical knowledge, it seems that farmers are not yet equipped with the correct information. However, it is encouraging to find from our quantitative analyses that training experience and information sources work to enhance the adoption of BMPs and that adoption of BMPs actually lead to a lower probability of disease outbreak. These findings validate the efforts made to promote and disseminate effective technical information to local farmers. In the next section, we observe a similar case in Thailand, where the farming practices of smallholders were transformed owing to the collective action by the stakeholders in the industry.

8.2.2 *Shrimp Industry in Thailand*

8.2.2.1 Overview

While the structure of the shrimp industry in Thailand is similar to that in Vietnam, it presents a very different situation in terms of shrimp farming practices. According

Table 8.2 Determinants of BMP score (5 max)

	OLS	Tobit	OLS	Tobit
	(1)	(2)	(3)	(4)
<i>Socio-economic characteristics</i>				
=1 if male	−0.238 (0.88)	−0.245 (0.95)	−0.167 (0.56)	−0.178 (0.63)
Age	0.007 (1.32)	0.008 (1.43)	0.007 (1.13)	0.007 (1.26)
Years of education	0.011 (0.44)	0.012 (0.50)	0.003 (0.14)	0.004 (0.19)
Years of shrimp cultivation	0.001 (0.19)	0.002 (0.25)	−0.000 (0.02)	0.000 (0.03)
=1 if belong to a cooperative	0.401** (2.12)	0.402** (2.21)	0.431** (2.14)	0.431** (2.27)
=1 if parents cultivate shrimp	−0.026 (0.16)	−0.039 (0.24)	−0.001 (0.00)	−0.009 (0.06)
=1 if siblings cultivate shrimp	−0.505*** (3.50)	−0.509*** (3.64)	−0.414*** (2.71)	−0.419*** (2.88)
Size of shrimp ponds	−0.014 (0.26)	−0.014 (0.26)	−0.021 (0.36)	−0.020 (0.36)
<i>Information sources</i>				
# shrimp buyers I know			−0.025* (1.68)	−0.025* (1.79)
# input sellers I know			0.028 (1.58)	0.028* (1.67)
# info source on technical issues			0.007 (1.10)	0.007 (1.20)
# info source on shrimp prices			0.002 (0.14)	0.004 (0.24)
=1 have received trainings before			0.270 (1.58)	0.266* (1.66)
=1 have had shrimps tested in a lab before			0.075 (0.45)	0.067 (0.43)
Constant	3.067*** (7.45)	3.051*** (7.72)	2.844*** (5.89)	2.820*** (6.19)

(continued)

Table 8.2 (continued)

	OLS	Tobit	OLS	Tobit
	(1)	(2)	(3)	(4)
Sigma		0.857***		0.838***
		(15.71)		(15.25)
R ²	0.22		0.26	
N	173	173	171	171

Note *indicates significance at a 10% level, **at a 5% level, and ***at a 1% level. All includes commune fixed effects. Absolute values of robust t-statistics are in parentheses. Columns (1) and (2) include only the socio-economic characteristics of farmers while Columns (3) and (4) also include information sources. Columns (1) and (3) are results of OLS estimations while Columns (2) and (4) are those of Tobit estimations

Table 8.3 Effect of BMP adoption on disease outbreak (PSM, Kernel matching)

More than 4 BMPs (1)	More than 3 BMPs (2)	More than 2 BMPs (3)
−0.390*** (3.59)	−0.211** (2.22)	0.012 (0.06)

Note *indicates significance at a 10% level, **at a 5% level, and ***at a 1% level. Bootstrapped t-statistics reported in parentheses. Column (1) indicates the Average Treatment Effect on the Treated from PSM when the treatment is defined as having used more than 4 BMPs while Columns (2) and (3) indicate the same when the treatment is defined as having used more than 3 BMPs and more than 2 BMPs

to the study in UNIDO-IDE (2013), the principal reason for the import rejection is bacterial contamination, and rejection due to the detection of veterinary drug residues is very small. According to our field survey and interviews with experts, instead of using antibiotics to prevent or cure diseases, the use of probiotics has become very common among shrimp farmers in Thailand. While bacterial contamination is also an important reason for port rejection, the source of this problem cannot be narrowed down to the producers' level as shrimps may be contaminated with bacteria even during shipment. This shows that the shrimp farming practices in Thailand are different from those in Vietnam.

Moreover, our study revealed that this has not always been the case in Thailand. The industry experienced a huge drop in the export volume of black tiger shrimp because farmers were using hazardous substances. As a result, the port rejection rate for Thai products was also high. However, when they realized that this would threaten the industry's survival, various stakeholders got together and changed the shrimp farming practices among smallholders.

8.2.2.2 Successful Transformation of Farming Practices

According to Holmstrom et al. (2003), farmers in Thailand regularly used antibiotics in 2000, when they conducted a 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 that 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 antibiotic residues. This explains the decline in export volume from Thailand in the early 2000s.

This experience was an important lesson for the Thai shrimp industry. A new species, *Litopenaeus vannamei*, was introduced in Thailand in 2003 and began to spread owing to its higher disease resistance. Because the Thai shrimp industry experienced high rates of import rejection, they were determined to change production behavior related to the use of antibiotics. As of 2016, farmers appear to have changed their production behavior dramatically. To minimize the possibility of disease outbreak, farmers implement various preventive measures, including the use of probiotics, careful water treatment by using two reservoir ponds, adopting a lower stocking density, and removing organic elements from the pond regularly. Although these production practices are labor-intensive, they are highly recommended and supported by the government and the private sector as a whole. How did Thailand achieve this transformation? We explain the important roles played by the government and private sectors below.

8.2.2.3 Role of the Government

The Thai government supports the farmers by (1) providing easy access to public laboratories; (2) requiring documents to assure traceability; (3) issuing certifications; and (4) conducting random monitoring. The Department of Fisheries (DOF) provides easy access to public laboratories to test free of charge the health and chemical residues of shrimp. Chemical residues 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 in southern Thailand. In addition to these large-scale laboratories, there are many regional public laboratories, and farmers can test their shrimp 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.

The second important role played by the government is to ensure traceability by requiring farmers to register and use what is called the “Movement Document (MD).” To farm 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.

The government also requires the transfer of the MD from sellers to buyers during every stage of shrimp marketing in Thailand. Two types of MDs are issued by the DOF; one of them is the “Aquatic Animal Fry Movement Document,” while the other is the “Aquatic Animal Movement Document.” 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 to obtain this document, DOF laboratories provide these 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 when shrimp are transferred to the processor. This MD moves along with the shrimp and is finally submitted to the DOF.

The third contribution of the government is issuing certifications. When a farmer registers with the DOF, compliance with national certifications of Good Aquaculture Practice (GAP) is mandatory. In Thailand, the National Bureau of Agricultural Commodity and Food Standards (ACFS) of the Ministry of Agriculture and Cooperatives plays a key role in setting standards for agricultural commodities. Two types of shrimp-related standards exist in Thailand, which are the Code of Conduct (CoC) and GAP.

Lastly, the DOF conducts regular monitoring of shrimp ponds based on the Sanitary Checklist of Shrimp Farmers, which is in accordance with 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, the DOF also controls the inputs.

8.2.2.4 Role of the Private Sector

The private sector also played an important role in transforming the practices. Probably the most unique and innovative feature of the Thai shrimp industry 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 two important organizations in the shrimp communities are the Thailand Shrimp Association (TSA),

which is an organization of shrimp farmers, and the Thailand Frozen Foods Association (TFFA), whose members are mostly frozen food processing and exporting companies. In each province, several so-called “shrimp clubs” are established and belong to the TSA. Their main activity is to hold seminars to share information about market price, conditions, and technical solutions to 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. 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 worth noting that virtual networks via social networking services (SNS), such as Facebook and LINE, function as very important devices for the shrimp farming community in Thailand. One Facebook group of Thailand shrimp farmers had about 18,000 members, as of March 2017. The group members constantly share their experiences related to shrimp farming. The information shared includes market prices, climatic information, preparing for different climates, preventing diseases, and dealing with shrimp diseases. As shrimp are very delicate aquatic animals whose health conditions change very quickly when a problem occurs, obtaining the appropriate information at the right timing 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.

Lastly, large private companies also offer assistance to 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 (e.g., the size of the potential harvest and prevalence of disease), which is important to plan processing and marketing abroad. They also obtain the trust of smallholders and are able to maintain a firm relationship for shrimp purchases.

8.2.2.5 Summary: Shrimp Industry in Thailand

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 through penalties imposed by the government, but are also provided with many practical tools to improve their production. Although farmers are not rewarded with prices that are higher than the ongoing market prices for adopting better practices, they have enough incentives to change their production practices.

This example of Thai shrimp industry presents a case where it was possible to change the farming practices of numerous smallholders with the collective action. Each stakeholder—the government, private sector, academia, and the farmers—took a role in changing the farming practices because they collectively faced a threat of a huge reduction in exports. In the process, the information sharing via SNS was the key. The well-functioning network was made possible by guaranteeing the authenticity of information by including professionals (academia) and holding frequent offline meetings by regional shrimp clubs to motivate farmers. This is a good example of “e-farming” and presents a good model for modern agriculture extension systems in developing countries.

8.3 Conclusion

In this chapter, we examined two important challenges faced by the developing country producers in accessing the global market—the presence of marketing risks and the difficulty in standards compliance. These are the challenges prevalent in the export-oriented, high-value agricultural and aquacultural industries, which are considered to play major roles in the early stage of economic development of emerging states. The greater demand and higher prices of these commodities in developed-country markets is expected to benefit producers of these crops in developing countries, thereby contributing to poverty reduction. Thus, it is important to understand how these challenges are faced and dealt with by the producers in developing countries.

We particularly took the cases of the pineapple industries in Ghana and Thailand to illustrate the presence of marketing risks, the ways producers have been affected by them, and the essential role played by the development of the processing industry in mitigating these risks. While the risk of having unsold fruit is large and is hindering the participation of relatively worse-off farmers in the pineapple export industry in Ghana, the same risk is very small in Thailand due to the diversity of processed items and their markets that exist to support the growers. In Ghana, the industry also experienced a sudden change in the variety of pineapples demanded in the multinationals-dominated global market, and this resulted in a huge loss of export volume and affected the ex-post surviving behavior of farmers. Development of a processing industry is also effective in reducing the effects of external demand shocks on smallholders.

Further, we explored the cases of shrimp aquaculture industries in Vietnam and Thailand to examine the difficulty of complying with international standards, particularly at the smallholder producers' level. We observed that the rate of rejection of exports at the ports of developed countries is high in the case of Vietnam—the major reason being the use of prohibited elements at the production stage. As the main producers in the industry are numerous smallholders, it is difficult to control the farming practices all over the country despite the governments' efforts to disseminate appropriate information and technology. However, the shrimp industry in Thailand presented an example of a successful transformation of farming practice

at the smallholders' level. The factors that contributed to the success include (1) the governments' efforts to provide free access to public laboratories to visualize the problem of residues and both controlling and regulating smallholder production with documents that assured traceability and (2) the private sectors' efforts to promote information sharing among various stakeholders using SNS and frequent offline regional meetings. Particularly because shrimp are very delicate and sensitive aquatic animals, the frequent exchange of information among various stakeholders, including experts from academia, seems to be very effective in maintaining effective farming practices among smallholders. The use of SNS can be a powerful tool to upgrade the agricultural extension systems in developing countries.

As observed from these examples, successfully overcoming the challenges posed by the global market to producers in developing countries seems to be the key to sustain the economic development of emerging states. Relying on inexpensive labor to attract foreign demand will not be sustainable as customers can easily switch the source of the supply when prices change. This chapter examined only two of the many challenges and it is important to document more evidence in this area to contribute to the sustainable development of developing countries.

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