



Global value chain and food safety and quality standards of Vietnam pangasius exports



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ABSTRACT

Increasing food safety and quality standards have imposed tremendous burden on pangasius market participants, and changed industry structure. The demand for safer pangasius products have encouraged the Vietnamese government to adopt its own practices, VietGAP, which encompasses all other international standards. The study examines how compliance with VietGAP and international standards influence pangasius value chain and serves as a catalyst in altering the industry structure. The author interviewed 41 processing and exporting firms and 91 farmers, and found vast changes in the structure and conduct of actors operating along the marketing chain. The value chain governance reflects its development and maturity and varies at various stages. The set of standards have fostered a number of changes in the pangasius industry in the past two decades, but the size and capacity of processing firms have amplified. The number of workers at each processing plant has also increased. There has been a slight decrease in the number of small-scale farms (less than 1.0 ha) and an increase in farms of more than 3.0 ha. The number of cooperatives has increased. The imposition of standards by the US and EU has encouraged Vietnamese exporters to search for other market alternatives. There has been improvement in marketing and a shift in exports to other import markets with less stringent quality requirements. Farmers, however, view the adoption of VietGAP as cost incurring with little benefits to them. Government must put policies in place to assist the small-scale farmers so they can meet the required standards.

1. Introduction

Since the 1990s, international trade in agricultural products has undergone a fundamental restructuring related to seafood safety and management as a response to actual or perceived consumer risks. Consumers' awareness of seafood safety is an important reason for these reforms. The changes include stringent public and private standards for supply chain control and greater emphasis on the social responsibility of fish traders. Supply chain control and social accountability have now become competitive weapons for the fish trader in the context of globalization of supply (Lee et al., 2010). The rise in standards influences the industry structure, marketing activities, actor conduct along the supply and value chain (Hammoudi et al., 2009), and corporate competitiveness repositioning (Giraud-Héraud et al., 2012).

Thanks to the market liberalization policy in 1990, Vietnam has expanded seafood trade and is now one of the largest seafood exporters in the world; pangasius and shrimp are the major export products. Pangasius exports from Vietnam now accounts for 91 percent of all pangasius traded globally (Centre for the Promotion of Imports from

Developing Countries CPI, 2015). Since the country's entry into the international market in 2000, 149 countries and territories import Vietnamese pangasius. However, under pressure from developed countries such as the United States (US) and European Union (EU), over the past decade, the seafood sector in Vietnam has faced a plethora of new standards (Lee et al., 2010), some with complementary effects, that have resulted in serious changes in the seafood industry. The overabundance of seafood safety standards has left pangasius industry management unsure of which ones to adopt and the effects on their firms. This has triggered a number of concerns and questions about the influence of standards on the nature of relationships and the type of governance among seafood firms. The key questions are: (1) Is the pangasius industry value chain changing in structure and governance due to pressure from importers to improve standards? (2) How are the various standards affecting farmers' decisions, industrial structure and governance; and (3) how should the pangasius sector organize producers and actors to join the global value chain? This study uses Gereffi and Korzeniewicz's (1994) global value chain theory to analyze the effects of changes in the structure and governance of the pangasius

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export value chain under the pressures of international and domestic standards.

Vietnam's reputation amongst its trading partners as a major exporter of pangasius is vulnerable to trade statistics showing levels of contamination and poor media coverage (Nguyen and Jolly, 2017). Food-borne illness is difficult to assess in any country but the level of contamination found in Vietnamese food for domestic consumption justifies public and trade concerns (World Bank, 2017). Without action by government to ensure that farmers and other market participants abide by standard requirements these problems are likely to worsen.

These international standards cover the fields of eco-system protection, food safety, social responsibility, traceability, public health and social welfare, but are numerous and likely to confuse the rural farmers as to which standard to adopt. In order to enhance the adoption of elements of all these standards and certification requirements, the government of Vietnam through the Directorate of Fisheries of Vietnam (D-Fish) decided to establish and adopt the Vietnam Good Agricultural Practices (VietGAP). This set of standards serves as a bridge leading Vietnamese pangasius enterprises and farmers to certification of other international standards such as Global Good agricultural practices (GlobalGAP), Aquaculture Stewardship Council (ASC), and others like Safe Quality Food (SQF) 1000 (Marschke and Wilkings, 2014). To facilitate the understanding of these standards the government of Vietnam has decided to establish VietGAP standard for export products including pangasius, consisting all points mentioned in the other international standards and at the same time allowing producers time to prepare for accreditation and certification of GlobalGAP, and the other international standards. This is to help Vietnamese pangasius exporters to minimize the difficulties in standard compliance and to meet various certification requirements in different world markets (Vietnam Association of Seafood Exporters and Producers [VASEP, 2018]). Hence, it is important to investigate how these standards influenced the governance structure of the pangasius industry and farmers' behaviour and reaction to those standards along the value chain. In this study, we examine the effects of standards on market participants' behaviour along the global value market chain.

1.1. Global value chain and governance

The term *global value chain* (GVC), first introduced and developed by Gereffi and Korzeniewicz (1994), has become a useful tool in the evaluation of food marketing and distribution. Governance in the value chain is the process of defining, communicating, and imposing compliance with standards along the value chain (International Trade Centre [ITC], 2011). Gereffi et al. (2005) identified five types of conceptual governance ranging from *market* to *hierarchy* related to the capacity to determine, and connect factors within a value chain, namely *market*, *modular*, *relational*, *captivity*, and *hierarchy*. Gereffi et al. (2005) suggested that the dynamic features of each governance type are influenced by three factors: the complexity of required information in product processing and service (design and process); the ability to systematize knowledge transfer within a chain; and the capability of suppliers in effective and reliable production. Table 1 presents the governance types modified to relate to the Vietnamese pangasius industry.

A low degree of power asymmetry between suppliers and end users characterize *Market-based governance* in which no single supply chain actor has control over other supply chain actors. Buyers meet specifications easily and loose linkages exist between value chain actors (ITC, 2011). At the opposite end of the range, *hierarchical-based governance* has the highest degree of control is concentrated in one lead firm that explicitly coordinates and controls the actors, as noted at the importer level of pangasius value chain and processors (ITC, 2016)

Modular governance reflects an arrangement of production relationships that can efficiently adapt product specifications to consumers' needs (ITC, 2011). **In the pangasius industry, processing**

firms must do upgrading to accommodate the wishes of the consumer, such relationship exist between importers and processing plants and producers in the pangasius value chain (Ponte and Sturgeon, 2014). *Relational governance* includes not just price and specifications but reputation, trust and mutual dependence and direct information and contact between end users and suppliers and such is the case between input providers and producers (Fig. 1). High informational complexity and ease of codification characterize *Captive governance* as in the case of the importers/distributors relationship, but low supplier capabilities, which lead to a one-way dependency on suppliers (Ponte and Gibbon, 2005).

1.2. Effects of standards on limited resource farmers

The rise of food standards in export value chains and the demand for consistent high volumes and good-quality produce have placed a burden on the resources of firms, especially small-scale producers, and forced them to integrate horizontally and vertically. The standards imposed on imports require costly investments that are beyond the reach of small-scale producers. Performance standards define product characteristics, conditions of production, processing, and packaging; the investments required may include cooling facilities, safety and quality monitoring, and packaging devices (ITC, 2011).

As competition moves from price based to quality based (Henson and Reardon, 2005), smallholder firms find it more difficult to upgrade their production, improve their quality, and participate in product differentiation (Gereffi and Lee, 2009). Some of the characteristics required by product standards bodies are not intrinsic to the product itself (Reardon et al., 2001). Consumers, especially in the UK and other European countries, often impose other environmental and social requirements.

The increase of standards has considerably influenced the length and operation of the supply chain (Hammoudi et al., 2009). First, standards might narrow a value chain (creating a direct relationship between producers and buyers). Second, standards compliance can also raise costs, put pressure on firm finances, and decrease marginal benefits, and might exclude small-scale farmers from the global value chain (Dolan and Humphrey, 2000; Swinnen, 2007). A study by Neilson (2008) showed that standards and certification lead to structural and governance changes in different ways, including the exclusion of some actors from the value chain while newcomers and others take on new roles; forward integration through private ownership of farms or participation of international traders upward of the chain; and backward integration via capital contribution mechanisms.

Cooperatives and business enterprises can be essential in helping small-scale enterprises (Saarelainen and Sievers, 2011), like those dominant in the pangasius industry, address value chain demands. Small-scale farmers may be unable to comply with stringent requirements due to lack of technical capacity (Reardon et al., 2001), which may lead traders and processing firms to reduce sourcing from small suppliers. Transaction costs for monitoring compliance with standards may also be very high in the case of sourcing from small holders (Swinnen, 2014). Bijman et al. (2011) indicated that with the aid of horizontal and vertical integration, cooperatives help to lower transaction costs and enable smaller-scale producers to compete in the global value chain.

Zuurbier et al. (1996) contended that horizontal integration elicits vertical cooperation. This is why vertical integration usually follows horizontal integration (Neven and Reardon, 2002). Horizontal activities include grouping together in the form of cooperatives to increase small producers' bargaining power and therefore strengthen their position in the value chain (Bijman and Hanisch, 2012). Under horizontal activities, cooperatives have a strong potential for reducing transaction costs and increasing economies of scale and scope, and with vertical coordination activities, cooperatives can have an important role in providing information about market requirements and supporting their

Table 1
Determinants of global value chain and governance matrix of types and features modified for Vietnam pangasius^a.

Governance types/ Features	Market	Modular	Relational	Captive	Hierarchal
Product specification	Simple	Complex, Modular	Complex	Complex	Complex
Price	Market price set by sellers	Same	Buyers/ Sellers	Cannot	None
Codification	Easy	Simple	Buyers exchange	High	None
Buyers input	Minimal	Buyers	High	Limited	None
Input cost	Low	Low	High	High	
Transfer cost	Low	Low	High	High	
Asset specificity	Low				
Information exchange	Limited	Little	Buyers and sellers exchange	Low	
Linkage	Limited	Arms-length	Social/ ethnic, reputation	Lead firm, Dependence	Vertical integration Managerial control
Producer competency	Capable of producing	Capable	High competency		None
Explicit coordination	Little	Little	Explicit	Explicit	Explicit

^a Source; Modified from Grereffiet al. (2005) and Ponte and Sturgeon (2014).

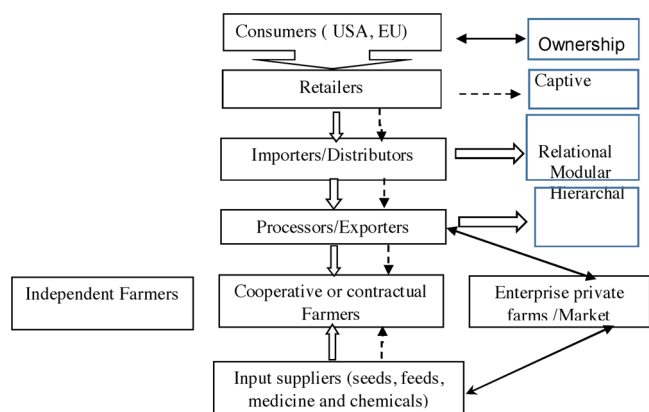


Fig. 1. Vietnam pangasius export value chain and governance. Source: Author's survey 2016.

members in complying with them (Saarelainen and Sievers, 2011). Hence, we hypothesize that increases in standards encourage firms to join cooperatives.

In this study, we examine how compliance with international and domestic standards influences the structure of the pangasius value chain and serves as a catalyst in changing the industry. We posit that cooperatives are essential in grouping small-scale farmers to meet required standards, and hence, participate in the global value chain.

1.3. Objective of the study

Identify the type of governance existing in the pangasius industry and determine how imposition of standards on pangasius exporters has forced value chain actors to upgrade their operations. Hence, it is important to determine:

- (1) The types of governance that pervade the pangasius industry and determine how farmers and market participants cope with the standards requirements as imposed by Vietnam Good Agricultural Practices,
- (2) The extent of the changes on the industry and market participants' conduct due to the governance changes fostered by these standards, and
- (3) How do pangasius farmers adopting the Vietnam Good Agricultural Practices differ in their evaluation of practices from traditional or non-practicing VietGAP farmers?

1.4. Methodology

In order to study the changes in the structure and management of the pangasius value chain under the pressures of global standards, we

followed a mixed-method approach using both quantitative and qualitative methods. We performed an extensive literature search and collected information to document the dates of certain events affecting the industry. Secondary data were collected by consulting the official publications of the Vietnam Association of Seafood Exporters (VASEP) and Vietnam Institute of Fisheries Economics and Planning (VIFEP).

Preliminary key informant interviews were conducted through in-depth non-structured questionnaires with CEOs, sales managers, and quality control managers to understand the enterprise operation from input to output, and with three sub-provincial farming bureaus. Subsequently, the study was formally conducted with a structured questionnaire. Non-probability sampling methods were used to distribute questionnaires to 50 enterprises (out of 130 according to VASEP statistics as of September 23, 2014). Forty-one useable questionnaires were completed from October 2015 to March 2016. The questionnaire was designed to identify the current competencies of the respondents in complying with the standards from importers, with a focus on their linkages with farming households, purchasing raw materials, and the ability to meet international standards of quality and food safety, environment, and labor.

Convenience sampling method was also used to collect data from 91 households in 2015 (29 households with Vietnam Good Agricultural Practices and 62 traditional households). The questionnaire was designed to determine whether their input factors resulted in advantages or disadvantages in complying with standards. The focus was on the forms of farming independent (individual farmers not belonging to any group), association (formal group but not yet recognized by Ministry of Agriculture and Rural Development (MARD) as a cooperative), and cooperative (recognized by MARD as a registered legal entity for conducting members business) and product consumption. The Statistical Package for the Social Sciences (SPSS) and Statistical Analytic System (SAS) were used to conduct descriptive statistics and simple CHI square (χ^2) analyses.

2. Results

2.1. Vietnam pangasius value chain

The value chain of Vietnam's pangasius exports includes major actors and supporters (Fig. 2). The government of Vietnam is the main supporting agent and is responsible for the overall legal and regulatory framework for the development of the pangasius industry, managed by Ministry of Agriculture and Rural Development. However, at the local level, the Department of Agriculture and Rural Development (DARD) represents MARD and is in charge of implementing and expanding the decrees and regulations to other relevant departments, lower management authorities, processing/export firms, and farmers. In addition, the Provincial Trade Promotion Center and the National Trade Promotion

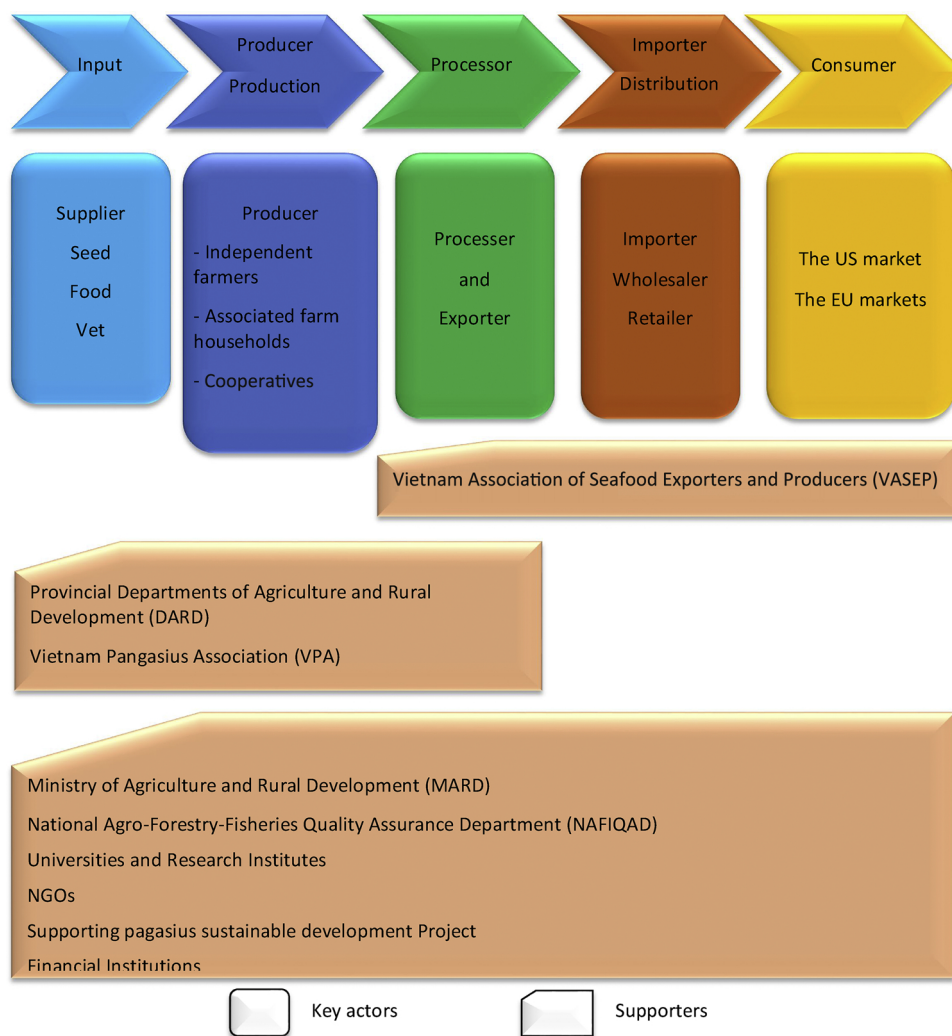


Fig. 2. Vietnam’s pangasius export value chain. Source: Constructed by author from literature search documents.

Center explore new export markets, as well as publicly broadcasting market prices and new developments in farming techniques and quality standards.

The National Agro – Forestry – Fisheries Quality Assurance Department (NAFIQAD) and Department of Animal Health support to the industry in the form of checking, controlling and certifying feed, fingerlings, and fish processing. International NGOs are involved in supplying information on food quality and safety standards to producers. The Vietnam Pangasius Association (VPA) is a social-professional entity established in 2013 and includes Vietnamese organizations and individuals operating in the fields of pangasius farming, processing, exporting, and research and services to support the sustainable development of the pangasius industry. VASEP supplies processors and exporters with information and training on quality and safety requirements.

The other actors in the value chain are merchants who supply inputs and relate to producers who are in contact with intermediaries or who market directly to processors of which some are both processors and exporters. The processors then market the fish products to importers and domestic wholesalers and retailers. The importers are responsible for the final distribution of the product on the international market.

2.1.1. Market/relational/modular form

The various types of relationships existing among the value chain actors are displayed in Fig. 1. The relational aspect of governance

persists between input providers and producers, and between producers and processors since producers must have the facilities and financial and technical knowledge to practice good production standards and obtain market-specification contracts from processors at the required level. In the market type of governance, supply-demand determines price, and quality is the most important factor in this type of exchange between producer and input provider. Producers source inputs from a large number of suppliers but at harvest producers distribute the majority of their output through one outlet. The information from the survey showed that up to 91.1 % of products to processors and directed the rest (8.9 %) to collectors.

2.1.2. Captive/hierarchical form

Vietnam is a major producer and exporter of pangasius. Two key importer markets (accounting for 40 % of export value) are the US and EU, with import value increasing from 2008 to 2011 and decreasing from 2012 to 2015 (Fig. 3). At present, Vietnam is responsible for 91 % of all pangasius exports and is competitive in the whitefish market, and therefore, must attempt to comply with buyers demands if it wants to remain competitive.

In the past 15 years, Vietnamese pangasius has been subjected to a series of food safety standards from the EU and US related to all stages of the supply chain “from pond to plate,” quality, labor, and environment. There are numerous standards imposed by various organizations that affect all aspects and actors operating along the pangasius value

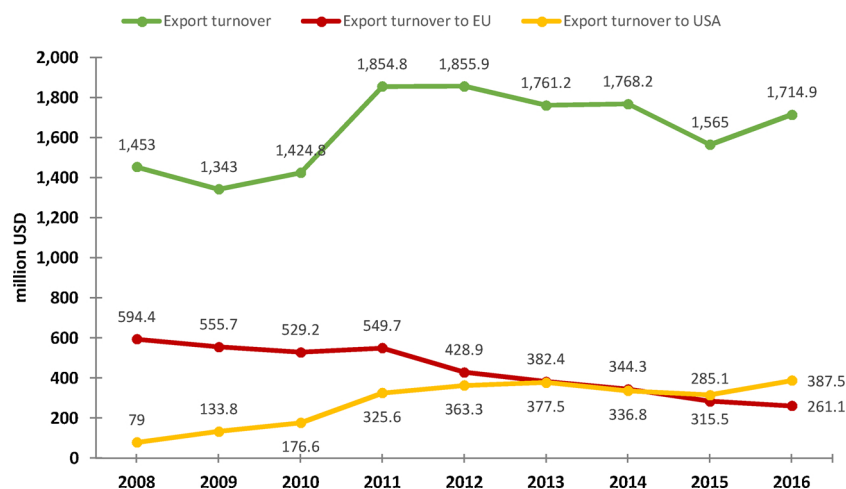


Fig. 3. Total pangasius exports from Vietnam to USA, EU and the world in millions of dollars from 2008 to 2016. Vietnam Association of Seafood Exporters and Producers (VASEP), Report on Vietnam Pangasius sector, 2008-2017, Hanoi, 2018

chain, but the most applicable standards for Vietnamese pangasius are Global Good Agricultural practices (GlobalGAP), Good Agricultural Practices (GAP), Best Agricultural Practices (BAP), Safe Quality Food (SQF), and Aquaculture Stewardship Council (ASC) (Table 2). Most of these standards affect all stages of the value chain except the environmental and social aspects. However, GlobalGAP, BAP, and ASC include requirements for environmental protection (Table 3).

Standards encourage exporters to seek importers with less stringent regulations. In Table 4, we observe that countries switch ranks as they seek market avenues with less stringent and costly standards regulations. The EU was the leading importer up to 2014 and the US was in second place. The US took the lead in 2015 and 2016 but China took the second place and the EU the third in 2016. China surpassed the US in 2017 and 2018 as the lead importer of pangasius, and the US was in second place and EU in the third until the other Asean countries replaced EU in 2016.

Most of the producers are small and independent. October 30, 2015, there were 75 certified farms by VietGAP on a total area of 686 ha, most of which were pangasius farms, with 42 units accounting for 361.5 ha (Table 5). The number of processing plants has diminished over the years, but firms have grown in size which suggests an increase in capital investment, and these firms are becoming more complex (Table 4). VietGAP producers sold 93.1 % of their products to processors, 3.5 % to cooperatives, and 3.4 % to collectors; traditional farming households sold 95.1 % to processors and 4.9 % to collectors.

There are approximately 100 pangasius processing factories concentrated in the Mekong Delta. The size of enterprises is based on capital and labor. In this study, however, the size is determined only by labor, due to the lack of information on capital. According to the Degree

56/2009/ND-CP on supporting small and medium firms, enterprises with over 300 employees are considered large scale, while the rest are small and medium. The survey showed that 87.5 % of the pangasius processing enterprises are large scale, with an average of 11 years of experience in pangasius exportation.

These enterprises have gradually upgraded their facilities, equipment, and personnel training to comply with standards. Also, 100 % of the pangasius processing companies have adopted Hazard Analysis Critical Control Point (HACCP), a mandatory international regulation for the global food industry. Based on HACCP, risk management standard systems for the whole production operation have been applied as follows: International Standard Organization (ISO) 9001 (69.0 %), ISO 22000 (37.5 %), ISO 17025 (12.2 %), and ISO 14000 (7.5 %). The percentages of enterprises complying with British Retail Consortium (BRC) and International Food Safety (IFS), standards from retailers in the UK, Germany, and France, are 75 % and 62.5 % respectively. About 65 % of enterprises comply with GlobalGAP, which has the goal of promoting good practices in agriculture to control the whole process from farm to table. Lastly, the standard for sustainable aquaculture (ASC) had the lowest attainment, with 32.5 % (Table 3).

2.2. Backward integration trends among processors and exports

Apart from integrating with producers, processing enterprises have a tendency toward another strategy—backward integration. The decision is whether to own private farms to supply inputs or contract with producers. The 2015 survey showed that 78 % of enterprises had built up their own farms that provided approximately 80 % of their materials. This strategy along with establishing processing plants has

Table 2
Legislation or enactment body for product safety by year by value chain stages for the Vietnam pangasius.
Source: Compiled from literature review from various sources.

No.	Governing body Legislation or enactment	Directed to or coverage						
		Year enacted	Production system	Product	Standards	Food safety	Processing	Environment
1.	SFQ 2000	1997	x	x		x	x	
2.	HACCP	1997	x	x		x	x	
3.	Global GAP	2007	x	x	x	x	x	x
4.	BRC	1998	x	x	x	x	x	
5.	IFS	1998	x	x		x	x	
6.	BAP	2010	x	x	x	x	x	x
7.	ASC	2011	x	x	x	x	x	x

Table 3Characteristics of governance and level of implementation by standards by periods for Vietnam pangasius industry^a.

Source: Compiled from literature review from various sources.

No.	Governance progression over time	Dates of adoption or implementation and organizations				Comments
		2000-2004	2005-2009	2010-2015	2015-present	
1.	General product certification	Yes	Yes	Yes	Yes	HACCP (100%), ISO 22000 (37.5%), IFS (75%), BRC (62.5%), Global GAP (65%); BAP, ASC (32.5%)
2.	Diversification	No	No	Yes	Yes	Global GAP, BAP, ASC, Value Added products
3.	Standards	Yes	Yes	Yes	Yes	Global GAP, BAP, ASC, ISO 22000
5.	Production system certification	Yes	Yes	Yes	Yes	ISO 9001 (53.7%) ISO 22000,
6.	Processing certification	Yes	Yes	Yes	Yes	HACCP, IFS, BRC, ISO 22000
7.	Product certification	HACCP, ISO 14.000, IFS, BRC	HACCP, ISO 14.000, IFS, BRC, Global GAP	HACCP, ISO 14.000, IFS, BRC, Global GAP, BAP	HACCP, ISO 14.000, IFS, BRC, Global GAP, BAP, ASC	
8.	Packaging requirements and specification	No	Yes	Yes	Yes	EU, USA required
9.	Food safety and quality certification	Yes	Yes	Yes	Yes	IFS, BRC, ISO 22000
10	Water quality certification					
11	Environmental certification	No	Yes	Yes	Yes	ISO 14000, (7.5 %), Global GAP, BAP, ASC

enabled several pangasius processors to move to hierarchal governance.

2.3. Temporal effects of standards on the industry

Area harvested annually, production, and exports did not decrease with the imposition of standards, but rather increased over time, with only a small dent in production in 2013. The structure of farm sizes changed, with major increases in large farms and a disappearance of smaller farms over time. The number of smaller processing plants decreased, but with an increase in investments and production capacity during the period from 2000 to 2005. The number of workers increased as the size of processing plants increased. At the early stages, a limited amount of pangasius was sold to processing plants, but today almost all production (93.0 %) is sold to processing plants. The role of collectors is increasingly declining, as processing plants purchase directly from producers (Table 6).

According to the survey, farming households are aware that the output consumption is stable when associating 75% with enterprises and 25% are farmed according to standards. Farm characteristics show hardly any difference in the years distribution between farmers complying with VietGAP standards and farmers practicing traditional culture ($\chi^2 = 13.37$; $p = 0.0002$). However, there were larger numbers of independent single traditional farmers (83.6 %) and farmers adopting standards (55.2 %) ($\chi^2 = 5.015$; $p = 0.0125$). The percentage of farmers who belonged to cooperatives and adopted standards was 20.6 %. There were zero traditional farmers belonging to cooperatives. Ponds for water and sludge treatment systems are part of the VietGAP requirements, and there were statistical differences between traditional farmers and those adopting standards. Farmers who adopt water and sludge treatment systems had a higher registration rate (96.6 %) compared to 35 % ($\chi^2 = 5.015$; $p = 0.00001$) for traditional farmers (Table 6). Vietnam Good Agricultural Practices requires that each farm has a size of 2.0 ha, with 0.25 ha for wastewater treatment.

Vietnam Good Agricultural Practices farmers had differences in feed cost from traditional farmers but there was no difference in feed conversion ratio (FCR) (Table 7). There was a major difference in perceived feed quality, as VietGAP farmers believed that they could control the feed quality. Farmers practicing VietGAP differed from traditional

farmers in their belief that there was a difference in seed quality ($\chi^2 = 13.58$; $p > 0.0002$).

Vietnam Good Agricultural Practices adopting farmers indicated that they regularly surveyed the environmental conditions under which they produced pangasius in comparison to traditional farmers ($\chi^2 = 33.52$; $p > 0.00001$), with more of the traditional farmers practicing self-treatment than VietGAP farmers ($\chi^2 = 34.92$; $p > 0.00001$). However, there were no differences in rates of loss from diseases between VietGAP and traditional farmers (Table 8).

There was not much of a difference in opinion of traditional farmers and farmers adopting the certification of standards. Farmers adopting standards differed in their answers on the factors influencing selling; for example, 39.3 %, 42.9 %, and 17.9 % stated that sales depended on size, quality control, and culture certification and standards, respectively ($\chi^2 = 35.21$; $p > 0.00001$). A significant proportion of traditional pangasius producers (95.1 %) said that sales were dependent on size, and only 1.6 % and 3.3 % of them said that sales depended on quality control and culture certification and standards, respectively. There were not many differences in the answers in price stability, sale price, and on sales outlet. Almost all farmers sold to processors, and 3.4 % of farmers who accepted VietGAP standards sold through cooperatives, but there were no traditional farmers selling through cooperatives (Table 9).

Many of the traditional farmers (70 %) said they looked at the standards but found them hard to follow, while 26.7 % said they listened but found them difficult to understand and 3.3 % said they had never heard of the standards. Most of the farmers (76.3 %) said that their main constraint in adopting standards was lack of infrastructure, while 8.5 % cited high capital requirements (Table 10). The rest of the farmers (1.7 % and 6.8 %) said that the culture techniques were complicated and that they were satisfied with the culture experience, respectively. Traditional farmers believed that the processing companies were the ones pushing the adoption of standards and not the government. However, 98.3 % said that they would be happy to adopt standards if they were provided with support.

Most of the farmers adopting certification (96.4 %) said they embraced VietGAP, while 3.3 % said they adopted ASC. A large portion of

Table 4

Changes in ranking of the ten leading importers of Vietnamese pangasius, 2008–2017. (For interpretation of the references to colour in this Table legend, the reader is referred to the web version of this article.).

Source: Report on Vietnam pangasius sector 2008–2017, VASEP (2018).

2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	3M/2018
EU	EU	EU	EU	EU	EU	EU	USA	USA	China	China
Rusia	USA	USA	USA	USA	USA	USA	EU	China	USA	USA
Ucraina	Ucraina	Mexico	Asean	Asean	Asean	Asean	China	EU	EU	Asean
USA	Asean	Rusia	Mexico	Mexico	Brazil	Brazil	Asean	Asean	Asean	EU
Mexico	Ucraina	Egypt	Brazil	Brazil	Mexico	Mexico	Mexico	Mexico	Brazil	Mexico
Egypt	Egypt	Australia	Saudi Arabia	China	China	China	Brazil	Brazil	Mexico	Brazil
Australia	Australia	Saudi Arabia	China	Rusia	Colombia	Colombia	Saudi Arabia	Colombia	Colombia	Colombia
Saudi Arabia	Saudi Arabia	Brazil	Australia	Saudi Arabia	Saudi Arabia	Saudi Arabia	Colombia	Saudi Arabia	Saudi Arabia	Saudi Arabia
UAE	Canada		Colombia	Colombia	Australia	Egypt	Canada	Canada	Canada	Canada
Canada	UAE	Ucraina	Rusia	Australia	Rusia	Australia	Egypt	Australia	Australia	Australia

EU— ; USA— ; - China— .

Table 5

Changes in farms, processing plants, employees and middlemen, of Vietnam pangasius producers from 2000 to 2017.

Source: Compiled from literature review and key informants.

Production of activity	Periods of growth and changes over time			
	2000 to 2004	2005 to 2009	2010 to 2015	2015 to 2017
Area in production (1000 ha)		6.012 (2008) 5.664 (2009)	5.394 (2010) 5.584 (2014) 5.623 (2015)	5.548 (2016) 6.077 (2017)
Changes in levels	almost	almost	Decrease	Decrease
Production in mil tons			1.01 (2014) 1.02 (2015)	1.11 (2016) 1.03 (2017)
No. of processing plants	Increase	Increase highly	Decrease	Decrease
No. of employees / processing firm	Increase	Increase	Increase	Increase
	Medium size Enterprises	Medium , large size Enterprises	Large size Enterprises (500 – 1000 employees)	Large size Enterprises (500 – 1000 employees)
No. of processing firm	Increase	Increase highly	Decrease	Decrease
Sold to Middlemen (%)	almost	Decrease	Decrease	Very Little
Sold to Processors (%)	Very Little	Increase	almost	almost
Exports (tons)	Increase	Increase	Increase	Increase
Exports (%)	Increase	Increase	Decrease	Increase

Table 6

Comparison of farm characteristics and practices of adopters of Vietnam Good Agricultural Practices and non-adopters (traditional farmers).

Source: Compiled from field survey 2015/2016.

Contents	Farms adopting standards		Traditional farms Non-adopting standards		Significance Prob
	Freq.	%	Freq.	%	
51. Experiences culture					$\chi^2 = 13.3$
< 5 years	2	6.9	3	4.8	$P = .0012$
5-10 years	9	31.0	44	71.0	
> 10 years	18	62.1	15	24.4	
5.2 Types of farmers					$\chi^2 = 5.01$
Independent	16	55.2	51	83.6	$P = .0125$
Coordinate with enterprises	10	34.5	10	16.4	
Cooperation members	6	20.6	0	0.0	
5.3 Acres					$\chi^2 = 4.9$
< 1ha	9	39.1	39	65.0	$P = .0840$
1-3ha	8	34.8	14	23.3	
> 3ha	6	26.1	7	11.7	
5.4. Infrastructure conditions					
5.4.1 Water supply and drainage system of households					$\chi^2 = 2.09$
General (supply and drainage system is one/or shared)	6	20.7	6	9.7	$P = .1481$
Separate	23	79.3	56	90.3	
5.4.2. Status of using electricity grid in aquaculture					$\chi^2 = 0.00$
Yes	23	79.3	48	78.7	$P = .946$
No	6	20.7	13	21.3	
5.5 Is the pond to reserve water and treat water?					$\chi^2 = 12.8$
Yes	13	46.4	7	11.9	$P = .0003$
No	15	53.6	52	88.1	
5.6 Waste water treatment system					$\chi^2 = 1.64$
Yes	9	36.0	14	22.6	$P = .1989$
No	16	64.0	48	77.4	
5.7 Sludge treatment system					$\chi^2 = 8.69$
Yes	21	72.4	23	38.3	$P = .0032$
No	8	27.6	36	61.7	
5.8. Register pond identification number					$\chi^2 = 23.5$
Yes	28	96.6	21	35	$P = .0001$
No	1	3.4	39	65	
5.9 Toilet separated from the breeding area					$\chi^2 = 12.6$
Yes	28	96.6	44	71	$P = .0004$
No	16	61.5	49	79	
5.10. Collective canteen for workers					
Yes			20	32.8	
No			41	67.2	
5.11 Labor protection equipment for workers					
Yes			35	58.3	
No			25	4.7	

the farmers (72.7 %) stated that they received certification in 2015. The others received certification in 2013 and 2014. The farmers were divided in terms of their motivation to adopt certification, with 51.9 % stating self-awareness, 19.9 % stating that it was because of pressure from the processing plants, and 29.6 % saying they had received state support. Farmers were equally divided on the criteria for selection of VietGAP, with 23.1 % citing buyers' request, 30.8 % value addition from importers, and 34.6 % because standards were easy to implement. The farmers adopting standards emphatically stated that crop yields were better (70.4 %) and disease control was better (88.9 %). However, a large portion of the farmers adopting standards (76.0 %) stated that there was no difference in prices received, even if 77.8 % of these

Table 7

Comparison of farm input use and quality of adopters of Vietnam Good Agricultural Practices and non-adopters (traditional farmers).

Source: Compiled from field survey 2015/2016.

Contents	Farm adopting standards		Traditional culture Non-adopting farms, without standards		Significance Prob
	Freq.	%	Freq.	%	
6.1. Feed sources provided					
Purchased	29	100	60	96.8	
Self-processing	0	0	2	3.2	
6.2. Feed quality					
Good	25	96.2	62	100.0	
Not Good	1	3.8	0	0	
6.3. Feed cost / total cost					
50-70 %	5	17.9	0	0	$\chi^2 = 13.3$
71-80 %	22	78.7	31	51.7	$P = .0002$
> 80 %	1	3.6	29	48.3	
6.4. Feed conversion ratio (FCR)					$\chi^2 = 3.71$
1.4-1.5	14	50.0	17	25.8	$P = .1559$
1.51-1.6	11	28.6	33	53.2	
1.61-1.7	3	10.7	9	14.5	
1.71-1.8			2	3.2	
2.1			1	1.5	
6.5. Analysis of feed quality control					$\chi^2 = 27.6$
Yes	21	72.4	10	16.1	$P > .0001$
No	8	27.6	52	83.9	
6.6. Quality of medicines for disease prevention and treatment					$\chi^2 = 3.95$
Good	24	88.9	61	98.4	$P = .0468$
Not good	3	11.1	1	1.6	
6.7 Seed supply					$\chi^2 = 4.53$
Own production	6	20.7	10	16.1	$P = .0332$
Buy from a reputable company	6	20.7	1	1.6	
Free purchase	17	58.6	51	82.3	
6.8 Seed quality					$\chi^2 = 13.5$
Good	27	93.1	60	96.8	$P = .0002$
Not good	4	13.8	59	95.2	

farmers thought that quality was better. A majority of the farmers (85.7 %) said that they would continue to apply standards. The farmers revealed that there were many advantages in applying standards, such as infrastructure conditions, seeds, feed, preventive medicine, and power systems, whereas the disadvantages included the product market demands and capital investment.

3. Discussion

Institutional support comes from the public and private sectors. MARD is the highest authority, responsible for the issuance of all decrees and regulations in the fields of product safety and quality, environmental protection, fisheries resource development and protection, veterinary drug use and production, and training on food safety and quality (Centre for the Promotion of Imports from Developing Countries [CPI], 2012). At the local government level, the Department of Agriculture and Rural Development (DARD) is in charge of implementing and expanding the decrees and regulations to other relevant departments, lower management authorities, processing/export firms, and farmers. The other supporting agencies at the local level are the Provincial Trade Promotion Center and the National Trade Promotion Center. The National Fisheries Quality Assurance and Veterinary Directorate supports the industry in the form of checking, controlling and

Table 8

Comparison of disease management and losses of adopters of Vietnam Good Agricultural Practices and non-adopters (traditional farmers).

Source: Compiled from field survey 2015/2016.

Contents	Farm adopting standards		Traditional culture Non-adopting-farm without standards		Significance Prob
	Freq.	%	Freq.	%	
7.1 Evaluate the culture environment					$\chi^2 = 33.52$
Yes	26	92,9	16	26,7	$P = .0001$
No	2	7,1	44	73,3	
7.2 How to treat the disease					$\chi^2 = 34.92$
Self treatment	6	20,7	44	72,1	$P = .0001$
Prescription drug dealer	6	20,7	14	23,0	
As instructed by the technician	17	58,6	3	4,9	
7.3 The risk level in fish farming when the disease occurs					$\chi^2 = 0.33$
Can handle	27	96.4	60	98.4	$P = .5679$
Loss 100 %	0	0.0	0	0.0	
Can only recover capital	1	13.0	1	1.0	
7.4 Rate of loss during farming process					$\chi^2 = 2.58$
< 10 %	1	3.6	3	4.9	$P = .4303$
10-20 %	12	42.8	33	54.1	
21-30 %	12	42.8	21	34.4	
31-40 %	3	10.8	2	3.2	
40-50 %	0	0	0	0	
51-70 %			2	3.2	

certifying feed, fingerlings, and fish processing (Suzuki and Nam, 2013). International NGOs play a vital role in ensuring that value chain actors are aware and observe regulations related to food safety standards and food quality (Khoi, 2007; Loc, 2006).

The Vietnam Pangasius Association (VPA) promotes pangasius and Universities supply research and extension information while VASEP supplies processors and exporters with information; training on quality and safety requirements and forms and proposes policies (SeaFish, 2015).

The government decision to implement its strategy for sustainable development of the fisheries sector rests on the issuance of Decision 1617/QĐ-BNN-TCTS on July 18, 2011, guiding the application of VietGAP standards for pangasius and shrimp, and Decree 36/2014 ND-CP to plan and set standards for the farming, processing, and export of pangasius products. Vietnam Good Agricultural Practices is supposed to be a comprehensive standard that would facilitate the task of compliance with a large number of regulating bodies but instead many farmers thought that they preferred GlobalGAP because VietGAP and the other standards do not provide sufficient market access (Pham et al., 2011).

Although food safety and quality are major issues in the regulatory framework, poor institutional enforcement hampers the implementation (Khoi, 2011). However, the government of Vietnam is embracing a more serious stance because of the importance placed on this export commodity. Thousands of pangasius or tra fish farmers in the Mekong Delta have accepted VietGAP, in spite of the information that 98.3 % of those surveyed said that they would be happy to adopt standards if government provided them with support. The government has encouraged the adoption of VietGAP through a MARD initiative of providing incentives such as baseline surveys, topographical surveys and analyses of soil, water and air samples to identify areas for concentrated production, plus training and financial support to farmers and businesses (Real, 2012; Towers, 2013).

The global seafood trade receives more regulation pressure with time according to a range of public and private standards. The

Table 9

Comparison of product marketing and sales of adopters of Vietnam Good Agricultural Practices and non-adopters (traditional farmers).

Source: Compiled from field survey 2015/2016.

Contents	Farm adopting standards		Traditional culture Non-adopting farm without standards		Significance Prob
	Freq.	%	Freq.	%	
8.1. The ability to selling pangasius products					
Unstable	25	86.2	61	100	
Easy to sell	4	13.8	0	0.0	
8.2 Buying price of fish material					
Reasonable. stable	1	3.6	0	0.0	
Unstable	27	94.4	61	100.0	
8.3. Purchasing prices depend on factors					$\chi^2 = 35.21$
Size	11	39.3	58	95.1	$P = .0000$
Quality control	12	42.9	1	1.6	
Culture certification in standards	5	17.9	2	3.3	
8.4. Purchasing channel of the household is most commonly used					$\chi^2 = .08$
Direct sales to processing enterprises	27	93.1	58	95.1	$P = .7758$
Sales to traders	1	3.4	3	4.9	
Sales to cooperations	1	3.4	0	0.0	
8.5 The purchase agreement is usually used					$\chi^2 = .00$
Oral agreement	3	10.3	6	9.8	$P = .9400$
Contract	26	89.7	55	90.2	
8.6 Expectations on the ability to consume					$\chi^2 = 2.47$
Very good	6	20.7	23	38.3	$P = .1161$
Precarious	22	79.3	37	61.7	
8.7. To be stable. sell at high prices. cultivating factors of interest					$\chi^2 = .61$
link with traders or processing enterprises	20	71.4	44	74.6	$P = .7639$
Raising standards for quality certification	6	21.4	13	22.0	
Link farming households together in the form of cooperatives	2	7.1	2	3.4	

pangasius industry in Vietnam responds to international consumers' demands, and therefore, it is buyer driven. Buyers' demands place pressure on processors and farmers to increase international food safety, quality and sustainability standards, and certification schemes (Nguyen et al., 2016). At present, processing enterprises prefer to source materials from contracted farmers and cooperatives. However, VietGAP-based households or cooperative members tend to be associated with processing plants more than traditional farming households.

The presence of global governance structures and stringent private food standards shape the strategic options available to smallholders, who confront three basic choices: upgrading, downgrading, or exit (Lee et al., 2010). According to the study by Neilson (2008) standards and certification proceed to structural and governance changes in different ways, including the exclusion of some actors from the value chain while newcomers and others take on new roles. In the past five years the number of small-scale pangasius farmers decided to exit and as the number of farms began to decline, giving rise to larger and more integrated farms, processors tried to engage in backward integration in order to control raw materials and standards (Phuong and Oanh, 2010; Trifkovic, 2013). Private standards, however, can be a catalyst for upgrading. Improving farming techniques and product quality to meet higher requirements permits participation in high value-added chains (Van Beuningen and Knorrninga, 2009). At the same time, some processors have tried to maintain production levels among the small farms through the process of vertical coordination and the formation of

Table 10
Knowledge of standards and willingness to adopt standards by traditional farmers and levels of significance.

Source: Compiled from field survey 2015/2016.

9. Knowledge		
Traditional culture		
Non-adopters- farm without standards		
9.1. Knowledge of standards applied to pangasius industry Viet GAP. Global GAP. ASC ...		
	Freq.	%
Not heard	2	3.3
Listen to but not understand these standards	16	26.7
Have a look but find it hard to follow the standard	41	70
9.2. Barriers to adoption of standards		
Infrastructure not respond	45	76.3
High capital	5	8.5
Culture technique complicated	1	1.7
Satisfied with culture experience	4	6.8
Fee certification high	2	3.4
Complex farming techniques	1	1.7
No difference in prices	1	1.7
Buying middle no needs certification	1	1.7
9.3. Without support to implement the standard will you implement the standard		
Pleasure to implement	59	98.3
Not implemented	1	1.7
9.4. If the government enforces Viet GAP how will the household react?		
Change to other culture	5	8.3
Work with processing enterprises	44	73.3
Conducting with other households	3	5
Learn to adapt	8	13.3

farmer clubs (Trifkovic, 2014; van Anrooy and Ha, 2014).

A large number of traditional farms are less than 2.0 ha, and therefore, in order to surmount the hurdles required for certification, the government has encouraged the formation of cooperatives. Since only VietGAP farmers participate in cooperative activities and the regulations require the placement of water treatment plants of 0.25 ha, famers with less than 2.0 ha are unable to receive certification because of this requirement. Since the year 2000, the country has seen a rapid increase in pangasius aquaculture production resulting in consolidation of a number of small farms although significant production also remains at the household level (that is family owned and operated farms) (Marschke and Wilkings, 2014). Vietnam Good Agricultural Practices allowed the formation of cooperatives as a mechanism of circumventing the regulatory requirements and to facilitate farmers who are unable to consolidate.

The number of processing plants has decreased, but the size and capacity of processing firms have increased. Processing plants have become more vigilant and have adopted a more market/modular/relational and hierarchical form of governance, controlling quantities and quality of product. This has resulted in the shortening of the value chain. As the market becomes more buyer driven, processing plants have embarked on upgrading strategies to modernize their plants (Lee et al., 2010).

Standards under the “pond to table” approach assure quality, food safety, disease safety, environmental safety, social safety, and traceability, and they relate to the complexity of information, the ability to systematize information (information about quality and attributes of the product) and the capacity of providers (compliance costs). Compliance costs are a focus of concern, and producers in Vietnam, especially small-scale producers, may have difficulties complying with new standards. Compliance costs include infrastructure upgrades, meeting practice guidelines and maintaining good production consistency, staff training and testing, and certification costs. According to Swinnen (2014) and Bijman et al. (2011), transaction costs for monitoring compliance with standards may also be very high in the case of sourcing from small holders, and they therefore, suggest that the

formation of cooperatives may help to lower transaction costs and enable smaller-scale producers to compete in the global value chain.

Most of the farmers surveyed stated that their main constraint in adopting standards was lack of infrastructure, a few cited high capital requirements. According to (Real, 2012), based on information from the Tra Vinh Agriculture Extension Centre, the cost of raising pangasius to meet VietGap standards is 20–25 % more when compared with traditional methods, but the benefits from adoption is greater than the costs and that is why so many local farmers decide to adopt it. Marschke and Wilkings (2014) also reported that the cost of modification to accommodate standard requirements could increase to about 20–25% without any fixed date of receiving compensation for such adoption (VietFish International, 2012).

In order to access the US and EU markets, producers and processors are compelled to adhere to their standards. As a result, the pangasius value chain has developed mixed governance styles (Fig. 2) where there is captive/hierarchical governance at the importer processor level but among other forms modular at the processor producer level. In the US retail market, for example, the Aquaculture Certification Council (ACC), sets the common standard while the retail market of the EU requires GlobalGAP and ASC certification. Importers of pangasius to the EU must meet these standards and provide information on operators throughout the marketing chain, and must have systems in place that supply information on traceability (Belton et al., 2011).

Governance may be modular or relational, in that the producers are compelled to invest in specialized assets in order to meet the customer's demands. As the survey revealed, farmers stated many advantages in applying standards, such as infrastructure conditions, seeds, feed, preventive medicine, and power systems provided by processors and the government, whereas the disadvantages included meeting product and market demands, and capital investment. In some resource contractual agreements processors supply most of the inputs and control the entire farming process. In return, producers provide land and labor only. Producers and processors make transactions on the spot, based on informal arrangements rather than strictly binding ones (Khiem et al., 2010). After deducting all the related costs, the processor pays the producer at the time of harvest and delivery.

This gives full control to the processor, who is subject to the risk of price fluctuations. Pangasius processors are obligated to comply with the demands of importers, and with a number of requirements including tracing the origins of processed pangasius products and applying a quality control system. Technical regulations and standards for food safety and hygiene during manufacture and sale of aquaculture products must be followed (Khoi, 2010). Producers and processors must obtain a certificate of food safety for their facilities from a competent authority, ensure the announced quality of pangasius products, carry out inspections and take responsibility for the announced quality, and label goods in accordance with the law (Lutz, 2016). In Vietnam seafood producers face bills of us dollar (USD) of 7,000–10,000 (European Union Currency (EUR) 6400 to 9000) per audit to become certified, and these audits must be repeated regularly every year or sometimes every two or three years (Urch, 2016). A large number of producers have only primary education and are not able to understand all the complexities of VietGAP, such as why the cost of annual audits. Another question is why should they invest in proper sanitary facilities for refuse disposal on a given location on the farm and why is this related to production using BAP, and therefore, these producers provide a captive audience to the processors. The need for small producers to work in cooperative groups may be the way of meeting these costs (Potts & Lynch, 2014).

At the early stages of industrial development, when the international market only required food safety control at HACCP and pangasius processing plants, standards were being initiated (Bush et al., 2009) and the value chain of pangasius was as follows: suppliers-producers-collectors-processors-distributors-consumers (Suzuki and Nam, 2013). Most of the producers were small and independent. Today the value chain of pangasius is: suppliers-producers-processors-distributors-

consumers. The role of the collector has been reduced infinitesimally over time, as processors seem to demand greater control of quality along the value chain. Transactions between producers and processors are more common and are made on the spot, based on informal arrangements rather than strictly binding ones (Khiem et al., 2010).

Vietnam is a major producer and exporter of pangasius. Two key importer markets (accounting for 40 % of export value) are the US and EU, with import value increasing from 2008 to 2011 and decreasing from 2012 to 2015 (Fig. 3). At present, Vietnam is responsible for 91 % of all pangasius exports and is competitive in the whitefish market, and therefore, sellers must attempt to comply with buyers demands if they want to remain competitive. However, the standards encourage exporters to seek importers with less stringent regulations.

4. Conclusion and recommendations

4.1. Conclusion

The vast number of international bodies imposing standards on imports has encouraged Vietnam to put in place its own comprehensive standards under the aegis of VietGAP, which attempts to include most basic components of the requirements of other bodies. The imposition of standards by the US and EU has also encouraged Vietnamese exporters to search for other markets; Asian exports surpassed EU imports in 2016 and 2017. China also has become the second largest importer of pangasius in 2017. There have been vast changes in the structure and conduct of actors operating along the marketing chain. The number of processing plants has decreased, but the size and capacity of processing firms have increased. The number of workers at each processing plant has also increased. There has been a slight decrease in the number of small-scale farms (less than 1.0 ha) and an increase in farms of more than 3.0 ha. The number of cooperatives has increased. Farmers who adopt Vietnam Good Agricultural Practices differ in their beliefs about feed, seed, quality but there were no revealed differences in FCR or losses from diseases. There has been an increase in the number of farmers adopting Vietnam Good Agricultural Practices, but non-adopting farmers think that the capital requirements are burdensome. These farmers indicated that they require government support or industry assistance to put in place the proper infrastructure for the adoption of Vietnam Good Agricultural Practices.

4.2. Recommendation

Under the pressure of standards from the US and EU markets, the Vietnamese pangasius export value chain is a buyer-driven chain, and includes many governance structures: market, modular/relational, captive, and hierarchy. The changes in value chain governance reflect the development and level of maturity of the pangasius industry. However, multiple governance structures characterize value chains that affect opportunities and challenges for economic and social upgrading (Dolan and Humphrey, 2000; Gereffi and Lee, 2009). In order to direct the pangasius industry to join the global value chain, the government should first consider the following:

- A Encourage farmers to integrate horizontally into cooperatives and integrate vertically with larger processing and exporting firms.
- B Establish formal contractual agreements between integrating partners since contracts can limit the risk to farmers by spreading the price risks, and sometimes the output risks, to a market participant who is in a better position to absorb them (and in some cases can help them control and reduce the risks). Each type of contract has different risks, depending on the ability of farmers to choose. However, the government can allocate only a limited sum and then encourage the participation of insurance companies to take over.
- C The government should continue to provide support to farmers in the form of credit or subsidies to enable them to adopt VietGAP.

Declaration of Competing Interest

There is no conflict of interest

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