

Effects of the ASC global value chain for small-scale prawn farmers In the Mekong Delta of Vietnam

Duc Nguyen

Emily Ogier

Institute of Marine and Antarctic Studies (IMAS)
University of Tasmania, IMAS Launceston
Private Bag 1370, Launceston
TAS 7250, Australia.

ABSTRACT

The Global Value Chain (GVC) approach was used to analyse the integration of different prawn production stakeholders in the Mekong Delta of Vietnam into the global value chain. The prawn value chain is an example of the buyer-driven chain in which international markets and major retailers use third-party certification, such as the Aquaculture Stewardship Council (ASC), to form an entry barrier for producing countries. Upstream of the ASC value chain, each stakeholder used their own governance tool to contribute to the production of prawn products that met recognised sustainable standards in response to environmental and social concerns. The GVC analysis suggested that adoption of ASC certification benefited small-scale farmers in the Mekong Delta by establishing contract farming between ASC farmers and seafood processors and input contracts between seed and chemical suppliers with ASC farmers. The presence of contract farming shortened the product flow from farm gate to seafood processors by reducing the number of intermediaries involved in the chain; therefore, contributing to increased share of the revenue for farmers. However, the ASC value chain is likely to exclude and compromise the livelihood of small-scale intermediaries who played an indispensable role in remote areas in the Mekong Delta of Vietnam.

Keywords: small-scale prawn farmers, Mekong Delta of Vietnam, ASC certification, value chain, donor support, farm co-operatives

1. INTRODUCTION

There has recently been increasing application of third-party certification schemes, such as GlobalGAP, Best Aquaculture Practices (BAP), Aquaculture Stewardship Council (ASC), and Naturland throughout the prawn farming industry in the Mekong Delta of Vietnam (Anh et al., 2011; Baumgartner and Nguyen, 2017; Marschke and Wilkings, 2014; Tran et al., 2013a) to source products acceptable for export markets, (Omoto, 2012) and promote sustainable development of prawn aquaculture for small-scale farmers (Tran and Bush, 2010). The third-party certification schemes are voluntary but in some cases they are becoming de facto mandatory for seafood producers for entry into certain markets, such as Europe (Washington and Ababouch, 2011). These schemes have functioned as tools to respond to substantial social, environmental, and economic issues generated by prawn farming (Blackman and Rivera, 2011; Marschke and Wilkings, 2014; Tran et al., 2012; Vandergeest, 2007). Additionally, certification requirements have reflected concerns of retailers and consumers in importing countries about food safety and quality (Bush and Oosterveer, 2012; Henson and Humphrey, 2012; Jonell et al., 2013) and of domestic markets in developing countries also (Holzapfel and Wollni, 2014). Certification schemes have been introduced to generate improvement in farming practices of prawn farmers in transition from conventional to responsible farming practices (Blackman and Rivera, 2011). Such schemes have achieved this by creating financial incentives, such as secure market access, sales contracts and price premiums, for farmers to

adopt and comply with certification requirements (Blackman and Rivera, 2011), thereby contributing directly and indirectly to improved livelihood and increased economic resilience of farmers (Corsin et al., 2007). One of the responses to these barriers facing small-scale farmers in adopting certification has been the development of introductory ASC certification programs for farmers operating in the Mekong Delta of Vietnam. The ASC certification program was launched to prawn farm cooperatives by WWF-Vietnam with support from international donors. The aims of the ASC program were not only focused on improving farming practices of small-scale farmers but also successfully integrating farmers into the global value chain as a means of poverty alleviation. However, the extent to which the design of the ASC introductory certification program has enabled small-scale farmers in the Mekong Delta to access the ASC global value chain has not been examined to date. Bush (2018) found that structure and function of the value chain might influence the capacity of farmers to respond to the adoption of certification in aquaculture while Schounten et al. (2016) identified the importance of locally embedded networks and social groups in understanding the effect and function of the global value chain. Studies of the global value chain of Vietnamese farmed prawn have included both sustainable certified prawn and non-certified prawn product global value chains (Duijn et al., 2012; Ho and Burny, 2016; Nguyen et al., 2017a; Tran et al., 2013a; Van and Bao, 2017). However, there is a lack of understanding of how and the extent to which certification supports small-scale prawn farmers integrate into these global value chains. The aim of this study was to identify the conditions for the establishment of the ASC certification value chain for small-scale prawn producers and the roles of each of the stakeholders (actors) in contributing to governing the certification value chain. In addition, this study aimed to examine the role of donors as secondary actors, and the design and effects of donor programs in supporting adoption of sustainability certification schemes.

1.1 GLOBAL VALUE CHAIN APPROACH

The global value chain (GVC) approach has been extensively used to explore the interconnected relationship between the production, distribution, and consumption of products where the vertically integrating global value chain has been established (Gereffi, 1995; 1999; Gereffi and Fernandez-Stark, 2016). The GVC approach has been used to explain flows of cross-border trade products in various primary industries such as automobiles, textiles and clothing (Gereffi, 1995), electric equipment (Golini et al., 2016), and in agri-food industries such as fruit (Mather, 2008; Sausman et al., 2015), and livestock (Rich et al., 2011). Across a range of industries different segments of the GVC have been identified but typically studies have examined inputs, production, processing, and distribution as the GVC segments (Figure 1). On the other hand, Gereffi (1995) suggested that the GVC included four dimensions: input-output structure, geographic dispersion, governance structure, and institutional framework. The details of four dimensions have been summarised by Bair (2009) and later by Gereffi and Fernandez-Stark (2016) and these dimensions were applied to this study.

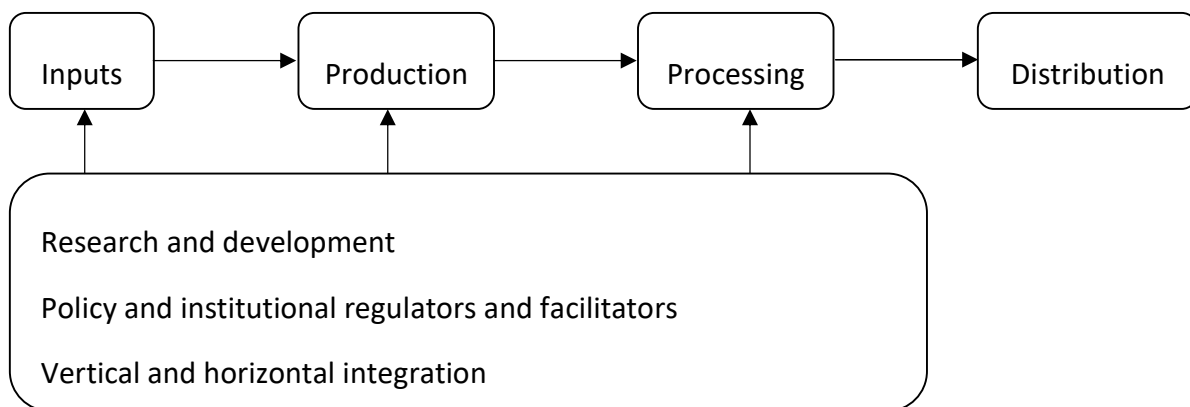


Figure 1: A general model of global value chain of the food products (modified from Tran et al. (2013a), Duijn et al. (2012), Nguyen et al. (2017a), Jespersen et al. (2014), and Gereffi and Fernandez-Stark (2016)).

This study adopted the GVC approach to examine the integration of small-scale prawn farmers in the Mekong Delta when adopting ASC certification. The GVC approach has been applied globally to examine the relationships between actors and multiple governance structures in value chains (Alam and Pokrant, 2009; Freitas et al., 2014; Kagawa and Bailey, 2006). Ho and Burny (2016) found that the prawn value chain in the Mekong Delta comprised primary actors (input-output structure), such as input suppliers, farmers, collectors, and

processors, and secondary actors (governance and institutional framework), such as Vietnam Association of Seafood Exporters and Producers (VASEP), Department of Agriculture and Rural Development (DARD), National Agro-Forestry-Fisheries Quality Assurance Department (NAFIQAD), banks, and research institutions. Similarly, Tran et al. (2013a) found that the global value chain of prawn in Vietnam consisted of four segments: inputs, production, collection, and processing. Market distribution has been also considered as one of the indispensable segments of the value chain (Gereffi and Fernandez-Stark, 2016; Macfadyen et al., 2005; Rich et al., 2011). In this study, five segments of the ASC value chain: input, production, collection, processing, and market distribution, were examined.

1.2 MEKONG DELTA PRAWN FARMING REGIONS

The case study used to examine the donor-supported ASC global value chain for farmed prawn in the Mekong Delta was small-scale producers in the regions of Soc Trang, Bac Lieu and Ca Mau provinces.

At the time of designing this study, there were approximately 200 small-scale farmers in the Mekong Delta adopting ASC certification involving approximately 600 ha of farming area. The ASC farmers were clustered into six ASC cooperatives in Soc Trang, Bac Lieu and Ca Mau (two ASC co-operatives in Soc Trang, one co-operative in Bac Lieu, and three co-operatives in Ca Mau) and farmed *Penaeus monodon* and *Litopenaeusvannamei*. A significant proportion of operators, approximately 59% of the total number of ASC farmers (116 ASC farmers) covering approximate 33% of the total ASC farming area (195 ha of ASC farming areas), were interviewed for this study.

Certification schemes have been available to the prawn farming industry in Vietnam since 2001 (Tran et al., 2015) but the production of certified prawn products was very low for a number of years, accounting for only 10.4% of the total prawn production in 2015 (Portley, 2016). In 2016, there were about 20 large-scale prawn producers and one co-operative (including 52 small-scale farmers) successfully achieving ASC certification, producing 18,600 metric tons of prawn and accounting for 3% of total prawn production in Vietnam (WWF, 2016). During this time there was a positive trend in demand for sustainably produced seafood products (Duijn et al., 2012), particularly in the US and Europe (Gutierrez and Thornton, 2014; Zander and Feucht, 2018). The production of certified seafood is low relative to projected demand, and there is capacity for the proportion of ASC product to increase in Vietnam to meet such demand.

2. METHODS

2.1 DATA COLLECTION

To characterise the ASC GVC and evaluate its effects on small-scale farmers, field studies were undertaken in which individual interviews and group discussions with participants in the prawn farming industry in the Mekong Delta were conducted using structured questionnaires to collect primary data from GVC actors. Specifically, the field study involved interviews of 116 small-scale ASC prawn farmers clustered in five ASC co-operatives in Soc Trang, Bac Lieu, and Ca Mau (Figure 2). The field studies were carried out in accordance to the Human Research Ethics approval to conduct field studies was granted by the Tasmania Social Sciences Human Research Ethics Committee (reference number H0015463).

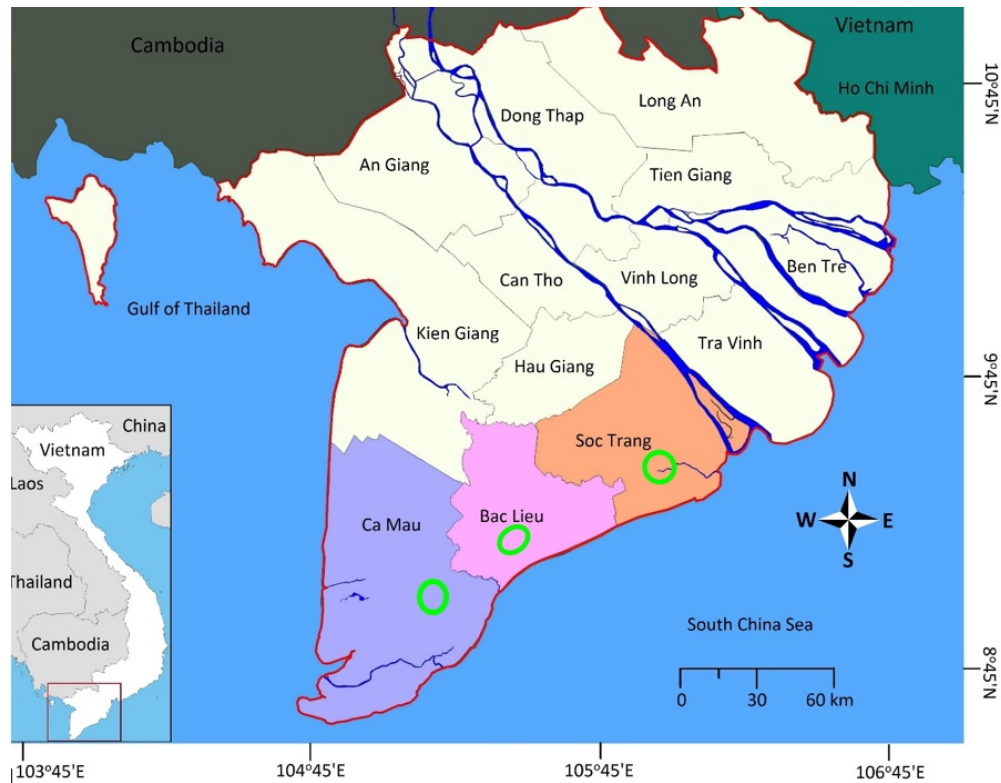


Figure 2: Map of the Mekong Delta with its 13 administrative areas (generated by using Google Earth Pro., version 7.1.1.1557, Google Inc. The Vietnam outline map was adopted from <http://d-maps>). ○: areas where sampling is carried out.

Before the field studies began, a Consent Form was sent to each participant. Where the participants agreed to participate in the study, they would sign the Consent Forms and the interview would begin. At interviews, farmers were asked a series of questions about sources of their purchased post larvae (PLs), contract farming and terms of reference in farming contract with seafood processors, and support from other stakeholders (i.e. local government, NOGs, chemical suppliers, PLs suppliers, institutions, etc.). Focus group interviews were also undertaken with managerial boards of the five ASC co-operatives to understand the structure of ASC co-operatives, types of effects of interventions of ASC and other actors on co-operatives, and roles co-operatives in adopting ASC certification and establishing contract farming with seafood processors. Additionally, interviews with eight seafood processors were carried out by face-to-face interviews and via email where required due to difficulties in arranging face-to-face interviews with some representatives of the seafood processors sector. Interview questions concerned different certification schemes that the processors adopted for their farms and their linkage farms, market distribution of certified and non-certified products, preliminary contents of contract farming between seafood processors with ASC farm cooperatives, and funding for the ASC farm co-operatives. Interviews with officers and representatives from various actors involved in accreditation, auditing, and compliance of standards (public and private or third party), including WWF-VN and local Department of Agriculture and Rural Development (DARD) in Ca Mau, Soc Trang, Bac Lieu. The interviews focused on roles of these actors in the adoption by farmers and markets of ASC, and in relation to shaping and governing the ASC value chain.

Secondary data were obtained from WWF-Vietnam, Vietnam Association of Seafood Exporters and Producers (VASEP), and DARDs, as well as from farmers in the study areas who, as part of the interview, provided access to their logbooks and farming records. Secondary data included publications, datasets, reports, statistical analysis, and legal documents.

2.2 DATA ANALYSIS

All data from the questionnaires were coded and entered into Microsoft Excel software for the GVC analysis. Data were coded, categorised, and descriptively analysed by NVIVO (version 11). Some data were also analysed

in Excel where this data was combined in multiple attribute analysis using data on prawn production attributes drawn from a related production analysis. Data codes were created deductively and inductively by the application of single value and multiple value coding methods recommended by Meyer and Avery (2008) and Ose (2016). Data were coded with three levels: the primary code conveyed content of the questions that reflected the topic of research; the secondary code was a summary of responses (such as multiple-choice responses, categories, and opinions); and the tertiary code included more specific information contained in responses that extended from the secondary code.

3. RESULTS AND DISCUSSION

3.1. CERTIFICATION AND INTERACTION WITH THE GLOBAL VALUE CHAIN

The study found that the process of achieving ASC certification was a multi-stakeholder initiative that involved non-government organisations (NGOs), government agencies (DARDs), and in some cases including seafood processors, collaborating to support small-scale farmers operating as co-operatives to upgrade their farming practices in response to social and environmental sustainability based criteria set out by ASC certification (Figure 3). When undertaking the processes of implementing and upgrading, farmers were provided with support from independent consultancy services and local DARDs in the form of technical assistance in understanding and completing requirements of ASC, and national and local legal documents. NGOs such as WWF-Vietnam and seafood processors provided financial and technical support to assist farmers in monitoring and auditing implementation of ASC criteria as well as in integrating into the value chain of ASC certified products.

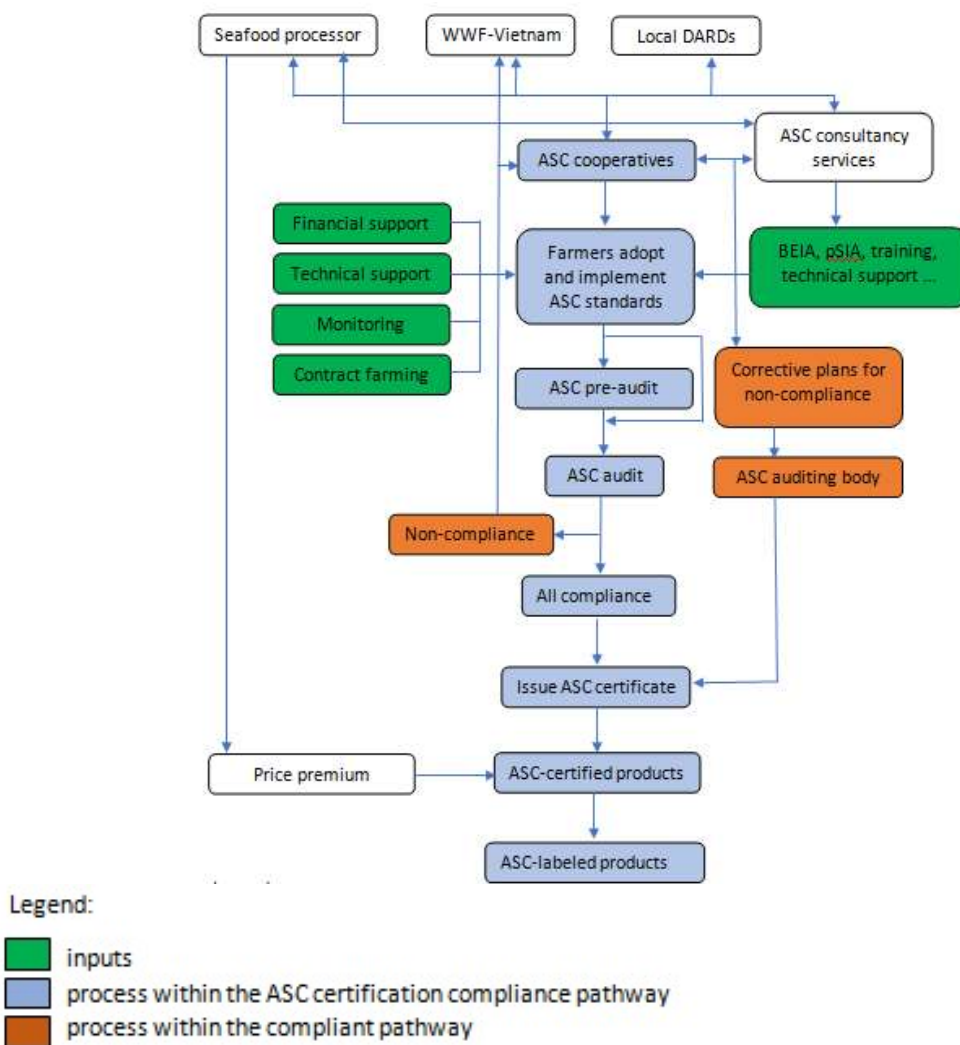


Figure 3: Conceptual framework for ASC adoption, implementation, and achieving certification in the ASC prawn value chain. Please publish this figure in colors.

Auditing is important in the value chain because it fulfills a verification function by ensuring that farmers comply with ASC certification and can therefore start to sell their ASC products to registered seafood processors in the ASC value chain. The auditing process was carried out by third-party ASC accredited auditors. The auditing process could include a pre-audit step in which the auditors generally inspected the level of conformity to certification criteria, which was not compulsory for the ASC. The final audit was the most important step and the results of final audit were sent to stakeholders stating conformity and non-conformity to ASC criteria. There are two types of non-conformity (NC); major and minor NC. However, the ASC has not provided detailed guidelines in terms of which criteria are major in the ASC standards for shrimp farming; therefore, determination of major or minor NC is the auditor's decision. Farmers and stakeholders have to provide a corrective action plan to fix any NC which in turn are sent to the auditors for further assessment. Once conformity with all ASC criteria are determined to be achieved or all the corrective action plan for NC has been accepted by auditors, the ASC certifier issues the ASC certificate for farmers as proof that farmers have successfully achieved a social and environmentally responsible level of farming practice.

3.2. INPUT-OUTPUT STRUCTURE OF THE PRAWN VALUE CHAIN

The input-output structure of the ASC prawn value chain includes all segments that formed a linkage between inputs and outputs of prawn (Figure 4). The role of ASC certification was to ensure all segments of the input-output structure achieved high quality input products and produced qualified output products that were in line with social and environmental sustainability policies of national and international guidelines.

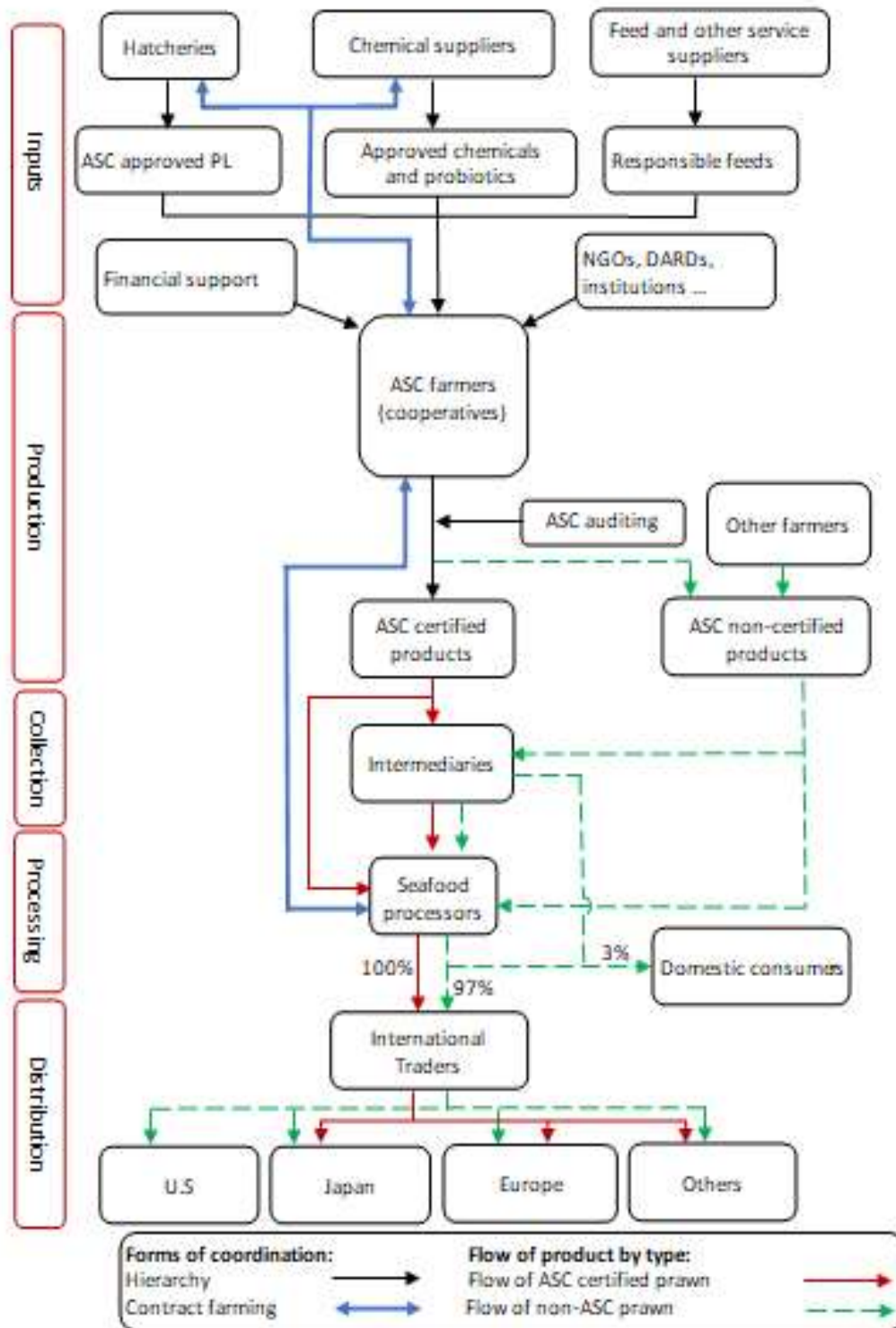


Figure 4: Components of value chains for ASC certified prawn and non-certified prawn in the Mekong Delta of Vietnam. Proportion of export and domestic consumption for non-certified prawn in 2013 was adopted from Portley (2016).

3.2.1. INPUTS

Input suppliers included several important actors such as postlarvae (PLs) suppliers (hatcheries), feed suppliers, chemical and veterinary drug suppliers, and other services such as equipment suppliers, financial providers, and

prawn-related services (Figure 2). In the ASC value chain, ASC certification involved three major input suppliers, including PLs, feed, and chemical suppliers.

3.2.1.1. POST-LARVAL INPUT

PLs quality has become one of the important inputs that has contributed to sustainable prawn production (Lavens and Sorgeloos, 2000). Therefore, the ASC certification scheme set requirements to ensure that prawn farmers obtained high quality PLs for their farming production. Stocking hatchery-reared PLs and natural-recruited PLs (wild PLs) were still allowed by the certification requirements but wild PLs recruitment was only for extensive and improved extensive models via tidal influx. In the current study, all farmers in all study regions regardless of certification status stocked PLs from hatcheries, although improved extensive farmers (ASC and non-ASC) in Ca Mau also recruited wild seeds by tidal influx when routinely conducting tidal water exchanges as a deliberate part of the production.

Prawn hatcheries operate across Vietnam but are clustered in Central Vietnam where 40% of total hatcheries are located, accounting for 70% of total PLs production (Tran et al., 2015). The hatcheries operated with two main Penaeid species, the domestic tiger prawn *P. monodon*, and the exotic white leg prawn, *L. vannamei*. To reduce a risk of spreading diseases to the prawn farming industry, quality checks on PLs prior to delivery to grow-out ponds became mandatory for all hatcheries and farmers by ASC certification and also by national regulations (i.e. Circular 32/2012/TT-BNNPTNT). Use of these stocks has helped to reduce disease outbreaks in culture ponds and removed pathogen contaminations from wild stocks, contributing to sustainable prawn aquaculture (Shields and Hajek, 2018).

Interviews revealed that polymerase chain reaction (PCR) tests have been vitally important for ensuring the continued productivity of intensive prawn farming but the tests have not appeared to be sought by extensive farmers, particular those who purchased the PLs locally. At the time of the study, PLs suppliers provided evidence from PCR disease checks of common diseases such as White Spot Syndrome Virus (WSSV), Monodon Baculovirus (MBV), Yellow Head Virus (YHV) and Hepatopancreas Parvovirus (HPV) for *P. monodon* and WSSV, MBV, YHV, and Taura Syndrome Virus (TSV) for *L. vannamei*. However, these checks for common diseases are not considered sufficient for ASC requirements as ASC requires a comprehensive disease tests for purchased and stocked PLs. Other major diseases such as Infectious Myonecrosis Virus (IMNV) (Senapin et al., 2011), Infectious Hypodermal and Haematopoietic Necrosis Virus (IHHNV) (Chayaburakul et al., 2005), Necrotising Hepatopancreatitis (NHP) (Vincent and Lotz, 2007), and Early Mortality Syndrome (EMS) (De Schryver et al., 2014; Hien et al., 2016) are considered important by ASC but have not been PCR checked by the PLs suppliers and farmers. The limited numbers of tests required was the result of inadequate protocols and facilities for proper pathogen diagnosis, particularly for new diseases (Briggs et al., 2004; Shields and Hajek, 2018) and increased operating costs due to disease diagnosis (Munasinghe et al., 2010). Lack of knowledge and awareness about prawn disease screening by farmers (Flaherty et al., 2009; Lestariadi and Yamao, 2017) also led to limited disease checks by PLs suppliers and farmers.

Interviews found that the cost for PLs with disease checks for improved extensive farmers in Bac Lieu in compliance with ASC requirements was 50% higher than normal PLs, leading to a significant increase in operating cost for farmers. To assist farmers implement ASC certification, seafood processors offered financial support for farmers to obtain ASC compliant PLs which was observed for famers in Bac Lieu. The key factor for achieving compliant PLs for certification was that farmers needed to conduct uniform stocking times for prawn production, which in turn reduced financial cost (i.e. reduced costs for bulk disease checks and transportation for purchasing a bulk amount of PLs) and minimized time-consuming disease checks. The financial support from seafood processors and the establishment of contracts between farmers and seed suppliers significantly reduced the economic burden for small-scale farmers when purchasing good quality PLs and contributed to establishing one of the initial integral segments in the ASC value chain. The comprehensive disease and quality testing requirements for ASC certification limited the likelihood of small-scale farmers, particular improved extensive farmers, achieving ASC-compliant PLs due to increased costs associated with PLs quality checks.

3.2.1.2. FEED INPUT

Artificial feeds have been used extensively in semi-intensive and intensive prawn farming systems because artificial feeds have been manufactured with superior characteristics such as balanced nutrient contents, high

water durability and stability, and know origins of feed ingredients compared to farm-made feeds or live feeds (Tacon et al., 2013). This study found that artificial feed input was the most significant economic burden for intensive prawn farmers, accounting for more than 50% of the total operating cost of prawn farming. Consequently, feed input requirements from the ASC certification have become problematic and costly for farmers. In contrast, feed has not impacted improved extensive systems because this farming system relied mainly on natural feed and used little artificial feed. There were about 53 feed mills in Vietnam in 2013, producing various types and feed sizes for prawn farming in Vietnam (Tran et al., 2013a). Interviews with stakeholders showed that the majority of prawn farmers in Vietnam across both small and large-scale and all certification status (ASC and non-ASC certification) used prawn feeds produced by Charoen Pokphand (CP), Grobest, Uni President (UP), and Tongwei. These companies had feed mills located in Vietnam but were owned by companies based in China, Taiwan, and Thailand.

Interviews with farmers revealed that feeds were sold to farmers through retail networks of the feed companies, although large-scale farms and companies had the option of obtaining feeds directly from feed mills. Interviews with small-scale farmers showed that they bought feeds from primary (37% of total farmers) and secondary feed retailers (63% of total farmers). Primary feed suppliers bought feeds directly from feed mills while secondary feed retailers bought feeds from primary feed suppliers. Feed prices ranged from 1.24 – 1.43 USD per kg and varied dependent on feed types, retailers, and ways that farmers paid for feed purchases. Farmers achieved better prices for feeds when they paid at the time of purchase. Alternatively, farmers had the option of obtaining feeds and paying after they finished the prawn farming cycles. Farmers obtained loans for a certain amount of time for feed purchases based on when the prawn production cycle was in operation (Tran et al., 2013a).

Achieving all requirements for ASC qualified feed has been challenging for small-scale farmers. Apart from declaration of all feed ingredients that account for at least 2% of the total feed ingredient weight of feed formula, traceability of origin of responsible ingredients became necessary for the feeds to comply with ASC requirements, particularly for fishmeal and fish oil. Additionally, costs incurred for producing ASC qualified feeds was another issue identified through the interviews. The study revealed that fishmeal and fish oil were major marine ingredients in prawn feeds, accounting for up to 20% and 2% of total ingredient weight in the feed respectively. As a result, ASC prawn feed prices increased due to increased prices for responsibly sourced fishmeal and fish oil (Huntington and Hasan, 2009). Similar observations have been found for fish feed in which tilapia feed that was compliant with sustainable certification requirements increased in cost due to increased prices of fishmeal (Ajani et al., 2016). Moreover, the demand for ASC feeds was significantly lower than normal feeds because the number of ASC farms was significantly less than non-ASC farms. At the time of this study, only a few feed companies (i.e. Grobest) could provide sufficient evidence to meet requirements for ASC feeds. No direct links between feed companies and ASC farmers to enable provision of ASC qualified feeds were found. Most of the ASC farmers obtained ASC qualified feed through a connection with seafood processors, resulting in a critical dependence of ASC farmers on seafood processors for the feed input segment.

3.2.1.3. VETERINARY DRUGS INPUTS

Chemical and veterinary drug use was another focus of the ASC certification scheme. However, requirements for veterinary drugs were simpler than other inputs. Veterinary drugs used in ASC ponds must be registered with Vietnamese authorities in accordance with regulations (i.e. Decision 03/2007/QD-BTS or Circular 23/2015/TT-BNNPTNT) to ensure quality, effectiveness, and safety of registered veterinary drugs. The direct equivalence between ASC criteria and regulatory standards for veterinary medicine has meant that integration of medical suppliers into the ASC value chain has not been problematic. At the time of the study, a prawn medicine company (LS Production Co. Ltd) had signed a contract with ASC farmers in Ca Mau, providing approved medicines at competitive prices for farmers, thus eliminating the price differentiation evident when purchasing medicines at local retailers. The adoption of ASC certification provided an opportunity for small-scale prawn farmers to co-operate directly with veterinary chemical companies.

Tran et al. (2013a) found that small-scale farmers in the Mekong Delta bought veterinary drugs from local chemical retailers who set the selling prices based on agreements between veterinary producers and local retailers. The authors also reported that loans for chemical inputs that veterinary retailers offered to farmers occurred when production cycles were carried out for a certain amount of time. For example, retailers have given loans to farmers who had prawn being farmed for at least two months for tiger prawns and at least one month for

white leg prawns. All loans had to be repaid when the production cycle was completed. This ensured that farmers would be able to repay loans to suppliers because prawn that have been grown for a certain amount of time would increase the likelihood of a successful farmed crop and reduce the risk of losing money when a production crop failed (Tran et al., 2013a).

3.2.1.4. FINANCIAL INPUTS

Financial support has come from banks, farmer credit unions and other input-supplier-based networks (Tran et al., 2013a). However, the accessibility of loans by small-scale farmers has become more strictly controlled following financial crises resulting from severe disease outbreaks (Tran et al., 2013b). Additionally, accessibility to the loans depended on socio-cultural and economic relationships and farmer creditability (Tran et al., 2013a). Apart from the above support, ASC farmers obtained financial support from seafood processors and NGOs to cover costs associated with ASC certification fees and PLs disease checks, for example. Support in the form of financial input has made it more viable for small-scale farmers to adopt ASC certification because it helped ASC farmers cover additional costs incurred during farming thereby reducing financial disincentives and barriers preventing farmers from successfully integrating into the ASC value chain.

3.2.2. PRODUCTION

3.2.2.1. PRAWN FARMERS AS ACTORS

Prawn farmers play a central role in the whole prawn value chain in taking inputs and producing products for seafood processing (Ho and Burny, 2016). In addition to production, the farmers were also the value chain actors that adopted practices that complied with requirements of certification.

This study found evidence of farming practices by farmers not adopting ASC that are furthermore non-compliant with national government regulations aimed at minimizing risks to biodiversity. Interviews with farmers revealed that 10% of non-ASC farmers in Bac Lieu stocked *L. vannamei* in the improved extensive system, potentially leading to increased opportunities for exotic species to escape to natural environment via tidal flows (Stickney, 2005) thus impacting the natural biodiversity. Although the level of negative impacts is contested (Hav and Leap, 2005), Ministry of Agriculture and Rural Development (MARD) recommended that *L. vannamei* should not be farmed in extensive/improved extensive systems (e.g. Official Document 3278/BNN-TCTS), to prevent escapees and resultant potential negative impacts of the species on natural biodiversity. In contrast, the interviews determined that ASC certification improved farmers' awareness of some negative ecological impacts related to introduction of exotic species to improved farming system.

3.2.2.2. CO-OPERATIVES AS ACTORS

Small-scale prawn farmers in the Mekong Delta of Vietnam operated their farms as either individual entities or under groups of co-located farmers called co-operatives. In this study, all ASC farmers were clustered in co-operatives. Cooperatives have been established by horizontal integration of small-scale farmers to receive support in farming techniques, knowledge, information, and other supports (Anh et al., 2011). Cooperatives also enabled small-scale farmers to upgrade functional and relational dimensions of production to successfully integrate into the global value chain (Phung and Pham, 2018). Additionally, focus group interviews revealed that the majority of co-operatives have established a fund from which co-operative members could borrow money at a relatively low interest rate to enable them to carry out production cycles and build financial capital.

Individual small-scale prawn farmers had little power compared to other participants in the value chain (Bush and Oosterveer, 2007; Ho and Burny, 2016), including negotiation with input suppliers (Ngo, 2013) and prawn buyers (Tran, 2004). Farmers' low ability or inability to negotiate was related to their low production levels (Tran et al., 2012), low technical skill levels, and lack of financial capital and market information (Ho and Burny, 2016). Therefore, the establishment of co-operatives enabled farmers to approach seafood processors directly because the cooperatives could function as large-scale farms that produced a large amount of production for the processors. Traditionally, prawn farmers obtained farm gate prices by intermediaries (Ho and Burny, 2016). However, this study found that farmers in the ASC co-operatives could obtain prawn prices and secure contracts directly from seafood processors through ASC contract farming. More importantly, the co-operatives were able to obtain from ASC certification programs a high level of support at a minimum cost. When adopting ASC certification, the financial, technical, and institutional support from NGOs, seafood processors, and DARDs

enabled the cooperatives to achieve a greater degree of vertical integration (sale contract for ASC certified prawn between seafood processors and ASC farmers, and sale contracts between the chemical company with ASC farmers). The ASC cooperatives also had opportunities to negotiate with seafood processors for price premiums for certified products and secure favorable deals with hatcheries and veterinary drug suppliers for lower cost inputs. As a result, ASC certification contributed to enhancement of farmers' capacity by incentivizing the establishment of farm co-operatives to overcome inefficiencies and uneven supply occurring when farmers operated their farms individually.

3.2.3. COLLECTION AND INTERMEDIARIES

Intermediaries, or so-called collectors or middlemen, were found to be important actors in the value chain connecting prawn farmers, including ASC farmers, and seafood processors. Similar to other studies (Ho and Burny, 2016; Tran et al., 2013a) on the value chain of prawn in the Mekong Delta, interviews conducted for this study revealed that ASC farmers and non-ASC farmers sold their prawn to seafood processors directly or through intermediaries. Duijn et al. (2012) reported that approximately 25% of prawn in Vietnam was sold directly to seafood processors while Tran et al. (2013a) found seafood processors bought only 4% of total prawn directly from farmers. Differences in findings of different studies were caused by geographic locations between prawn farms and seafood processors, social and economic relationships between the farmers and seafood processors (Tran et al., 2013a). Bui (2011) found that about 70% of prawn farmers in KhanhHoa province, Central Vietnam sold the prawn to intermediaries while the rest sold directly to seafood processors. These findings were in contrast with the current studies about flows of prawn from producers to seafood processors in KhanhHoa province of central Vietnam (Nguyen et al., 2017a) and in other countries such as Bangladesh (Barmon et al., 2011) and Ecuador (Anhalzer and Nanninga, 2014) where all farmed prawn went through intermediaries before the prawn came to seafood processors.

Non-ASC farmers in the case study regions sold prawn through intermediaries and seafood processors via verbal agreements. In contrast, this study found that ASC farmers and seafood processors have discussed and established formal contract farming arrangements for purchased certified prawn. The effect of these arrangements was to help farmers to overcome financial constraints arising from uncertainty of revenue, poor access to inputs, lack of technical and managerial capacity, and ensure market access, while the buyers could secure the input of sustainably produced products at reasonable volumes for their business (Ragasa et al., 2018; Setboonsarng et al., 2006). However, farmers achieved the ASC certificate under the name of the contracted seafood processor, meaning that the seafood processor holds the ASC certificate and farmers were only sub-contactors for the seafood processor. This was to ensure that the farmers did actually grow to ASC standards in order to meet their contract conditions. This also meant that farmers could only sell ASC-certified prawn to the contracted processor in order to achieve price premiums for the products. This increased the dependence of small-scale farmers on seafood processors in selling ASC certified products. Farmers could choose to sell prawn to other seafood processors but prawn would be sold as non-certified prawn and price premiums were not accredited to the farmers. This study revealed that intermediaries were not participants at the time when discussions or contracts were signed between ASC farmers and seafood processors, indicating that intermediaries have been excluded in these cases from the ASC value chain. This finding is similar to that of another study about the prawn value chain associated with ASC certification in Indonesia where small-scale intermediaries were ignored and not directly visible in the supply chain (Douma and van Wijk, 2012). The exclusion of small-scale intermediaries from the value chain is likely to have occurred because the traditional value chain comprised several intermediaries which caused traceability issues for certified prawn from farms to intermediaries then to the seafood processors (Duijn et al., 2012). As Ha et al. (2012) found in their study of the organic certification value chain, prawn came through several intermediaries before it was received by seafood processors, leading to increase risks of incidences of mislabeling between certified and noncertified prawn.

Due to the nature of small-scale prawn production and trading (Tran et al., 2013a) and less developed infrastructure for transportation in remote areas (Tran et al., 2013b), a degree of vertical integration between farmers, seafood processors, and intermediaries has become necessary in the context of the ASC value chain to enhance the livelihood of the communities and ensure the viability of the value chain in these remote areas. However, concerns about quality control and traceability systems and their level of compliance with ASC certification have been raised for intermediaries. Therefore, it has become necessary for intermediaries in these remote regions to focus on quality control and traceability for them to be integrated into the ASC value chain.

3.2.4. PROCESSING: SEAFOOD PROCESSORS AS ACTORS

Seafood processors acted as the final segment of the input-output structure of the value chain where they turned raw material (fresh prawn) into final products for markets. In the ASC value chain, the seafood processors also contributed to the vertical integration between ASC farmers and consumers of ASC certified prawn. Interview data shows that seafood processors are a strong actor in the value chain because they have had power over the value chain to control the prices of farmed prawn and thereby create drivers for farmers to farm prawn responsibly, and have acted as a unique channel of communication between prawn farmers and international buyers and traders. In the ASC value chain, seafood processors cooperated with NGOs and DARDs for sourcing ASC certified prawn and finding potential sources of ASC prawn by establishing commodity linkages with farm cooperatives.

There were more than 550 registered seafood processors in 2013 in the Mekong Delta (Tran et al., 2013a), but this study revealed that only four seafood processors have formed commodity linkages through contract farming with ASC small-scale farmers at the time of the study. All interviewed seafood processors (eight processors) had their own farms or linkages with large-scale farms for sourcing of ASC certified prawn; therefore, sourcing ASC certified products from individual small farms was not necessary, especially when the sustainable certified products were destined for niche markets (Douma and van Wijk, 2012; Marschke and Wilkings, 2014). Small-scale prawn farmers produced small volumes of certified products (Phillips et al., 2007), making it inconvenient for seafood processors to obtain the desired volume for export. Hence, through the formation of cooperative clusters of linked small-scale farms, small-scale producers were collectively able to supply ASC seafood processors. Interviews with seafood processors who signed farming contracts with small-scale farms clustered in ASC co-operatives determined the perceived benefits of the linkages, which are that they: (i) provide a large and stable source of production through concentration of products under co-operatives arrangement, (ii) control the quality of prawn, (iii) obtain support from local government, (iv) create a close relationship between ASC farmers and seafood processors, and (v) limit the product flowing through many intermediaries.

3.2.5. DISTRIBUTION: GLOBAL MARKETS AND GEOGRAPHIC SCOPE OF CERTIFIED PRODUCTS

Interviews with seafood processors revealed that certified products accounted for a significant proportion (23%) of prawn exports although the majority of products (i.e. whole frozen prawn, peeled prawn, and cooked prawn) came from non-certified sources (Table 1). The BAP scheme accounted for the greatest proportion of exported prawn product by the interviewed stakeholders. The share of GlobalGAP was not calculated in this study because there was a lack of data about GlobalGAP certified products at the time of the study.

Table 1: Percentage of export prawn production under different certification schemes in 2015. GlobalGAP was not included.

Certification scheme	Proportion (%)
ASC	7.5
BAP	15.3
Naturland	0.2
Non-certified	76.9

Each of the certification schemes targeted specific international seafood markets. Washington and Ababouch (2011) summarized certification requirements for each of the global markets and revealed that some certification schemes were developed for a distinct market. As a result, each seafood processor acquired multiple certifications to deal with requirements of each international market. Breukers (2015) found that multiple certification for coffee enabled producers to gain access to a various market, deal with fluctuations in demand, and obtain the premium enabled by a particular certification scheme. As outlined by Bush et al. (2013), the acquisition of certification under multiple schemes also applies to sustainable aquaculture products. This study found that each seafood processor sourced from producers under different certification schemes for different distinctive markets. Specifically, ASC-certified prawn were exported globally but were focused on Europe (95.3%) and some other international markets such as Japan, Thailand, Hong Kong, and Singapore while some other certification schemes only targeted specific international markets, such as Naturland for Europe and BAP for US markets (Table 2).

Table 2: Targeted markets for a selection of international certification schemes in the Mekong Delta of Vietnam in 2015.

Organisation	Certification	Market share (%)			
		EU	USA	Japan	Other
Aquaculture Stewardship Council	ASC	95.3	-	3.6	1.2
Global Aquaculture Alliance	BAP	-	100	-	-
Naturland	Naturland	100	-	-	-

Although certified prawn products were exported worldwide, Marschke and Wilkings (2014) found that the certified products were exclusively exported to niche international markets while non-certified products accessed a wider range of international export markets. Similarly, Jonell et al. (2013) revealed that there was a continued demand for certified seafood products in US and Europe markets.

According to VASEP (2018), Vietnamese-produced prawn was exported to 92 countries worldwide with the major prawn export markets being EU, USA, Japan, Korea, and China -all of which accounted for up to 85% of total export value in 2015. In that year, USA was the largest import market, accounting for 23% of total export value for Vietnam; followed by Japan, Europe, and China with 19%, 18% and 12% respectively (Table 3). However, the proportion of total certified products for each market has not as yet been determined, leading to a lack of information about the dispersion of certified prawn products into global markets.

Table 3: Top five largest import markets of total Vietnamese prawn (% share in value). Data provided by VASEP (2018).

Market	Export share (%)
Europe	17.8
USA	23.2
Japanese	18.5
Korean	8.4
China	12.4
Other	19.7

3.3. GOVERNANCE

The pathways made available to small-scale farmers for integrating into the global value chain were through components of its governance structures. These include the market, third-party and government-based governance tools established through contract farming with seafood processors, and support programs and interventions by other external sectors such as WWF-Vietnam and DARDs, as a solution to help small-scale farmers cope with responsible farming and increase their position in the international marketplace.

3.3.1. ROLES OF INTERNATIONAL MARKETS

According to Tran et al. (2013a), the prawn value chain in Vietnam has been considered as a buyer-driven chain. This was confirmed by interviews with seafood processors showing that international prawn buyers and importing countries require specific standards and regulations for farmed prawn product in the Mekong Delta of Vietnam. These lead firms have increased their influence on the seafood value chain (Larsen, 2014) by the application of certification schemes as one of the governance measures to ensure their import products meet their food quality and safety requirements (Zach et al., 2012) and come from sustainable sources (Hatanaka, 2014). Moreover, the certification schemes have established vertical and horizontal linkages between stakeholders and specify characteristics of each production segment and responsibilities of each stakeholder in the value chains (Bolwig et al., 2010).

Retailers in major international markets such as Japan, Europe, UK, and North America are committed to purchase farmed seafood from third-party certification programs such as BAP, and ASC (Bush and Oosterveer, 2015; Swartz et al., 2017; Washington and Ababouch, 2011). These certification requirements from major international markets have created pressures for actors upstream of the value chain in the Mekong Delta of

Vietnam, particularly for small-scale prawn farmers and intermediaries in remote areas to upgrade their farming practices to meet an increasing demand of responsibly farmed prawn (Tran et al., 2013a).

3.3.2. BUYER-DRIVEN CHAINS AND ROLES OF CONTRACT FARMING BETWEEN SEAFOOD PROCESSORS AND SMALL-SCALE FARMERS

Large seafood processors handling prawn produced in the Mekong Delta region were also seafood exporters who worked with international traders to sell prawn from Vietnam to international markets. Due to the buyer-driven governance of the value chain by major international markets, the Vietnamese prawn processors have increasingly sourced prawn from producers who can demonstrate responsible farming practices. However, prawn processors in Vietnam have been faced with obstacles in controlling quality and traceability for farmed prawn (Tran et al., 2013a). To solve these issues, the seafood processors in the Mekong Delta of Vietnam cooperated with small-scale farmers to support the farmers adopting ASC certification and guarantee sources of responsibly-produced prawn for export. The partnership was established through written contracts between processors and the farmers. Interviews with stakeholders revealed the processors used financial support and price premium as governance tools to ensure the ASC farmers comply with the certification requirements and sell ASC certified prawn to the processors. The financial assistance came in different forms of support, such as absorbing or meeting farmers' costs for disease checks of seed inputs, for adopting the ASC certification scheme, and for auditing costs for ASC certification.

The contract farming arrangement in the ASC value chain provided benefits to small-scale prawn farmers in the Mekong Delta of Vietnam in terms of credit, technical advice, and ultimately improved livelihoods and the welfare of small-scale farmers in a similar manner to contract farming in the avocado value chain in Kenya (Mwambi et al., 2016). However, concerns about the transparency of pricing mechanisms have been raised. In the case of the organic prawn certification program in the Mekong Delta of Vietnam, different farmers were reported to have received different price premiums (Omoto, 2012; Tran et al., 2012). This study found that some ASC farmers reported receiving a different price premium compared to other farmers in the same ASC co-operative. However, seafood processors interviewed for this study reported that the price premium was listed in the farming contracts with farmers and was consistent amongst farmers in the same ASC co-operative. In the absence of transparency of pricing mechanisms (i.e. the price premium was inconsistent across the farmers within a cooperative or price premium was lower than it was stated in the farming contracts), small-scale farmers with contract farming arrangements are at risk of losing their power in negotiating the sale price with the processing firms (Warning and Key, 2002) and ensuring their share of the price premium gained through certification, and of subsequently reduced incomes (Mwambi et al., 2016).

3.3.3. ROLES OF WWF-VIETNAM

There have been increasing efforts to reform traditional prawn farming practices by application of third party certification schemes to produce prawn products which address social, environmental and food safety concerns by consumers, retailers, and NGOs in global markets (Hatanaka, 2010). In addition to GlobalGAP, BAP, Naturland and other schemes, which have long been developed and applied in prawn aquaculture, the ASC certification scheme for prawn aquaculture was established in 2014 by the World Wildlife Fund (WWF) and the Sustainable Trade Initiative (IDH). The intent of the ASC certification scheme program was to promote best environmental and social practices in aquaculture through credibility, effectiveness, and added value (WWF and IDH, 2014). In the Mekong Delta of Vietnam, the ASC certification was disseminated to small-scale farmers by WWF-Vietnam along with the WWF-Vietnam's donor program that also provided financial, technical, and institutional support. The financial support was to provide funding for farmers to pay for ASC costs (i.e. cost for pSIA and BEIA studies, cost for ASC-approved feeds, and cost for audit) while the technical support was to strengthen farmers' capacity in reforming conventional farming practices to meet requirements of ASC certification standards. WWF-Vietnam has also initiated institutional support to farmers by incorporating the donor program with ASC consultancy services to deliver training to farmers to strengthen their capacity and awareness.

Apart from working directly with farmers, WWF-Vietnam also worked with state DARDs to support farmers to shift their conventional farming practices towards responsible prawn farming in compliance with ASC and local and national regulations addressing social and environmental sustainability. WWF-Vietnam also collaborated

with WWF's networks to work with international retailers and seafood processors to form linkages between producers and consumers, creating a prawn value chain to ensure outputs for ASC farmers and ASC certified prawn distinct from non-certified prawn.

Interviews with WWF-Vietnam showed that the ASC certification scheme is considered complicated and requires intensive work to implement while small-scale farmers' capacity to do this is limited. As a result, adoption of ASC certification by small-scale farmers has been a lengthy process and required interventions and integrated approaches including technical support (e.g. prawn farming techniques from pond preparation to harvesting, prawn health management, and farming records and record keeping) and the strengthening of group management and economic incentive initiatives for small-scale farmers to use natural resources more efficiently in prawn farming practices, reducing operational costs and improving quality and productivity. Interviews with WWF-Vietnam staff and group discussions with ASC co-operative managers revealed that a number of co-operatives had replaced their existing certification programs with ASC certification: three cooperatives moved to the ASC certification program from the BMP program and one cooperative moved to ASC from VietGAP. These schemes created an entry point for international certification adoption. This suggested that the adoption of ASC certification of small-scale farmers needed an extended time and transition pathway to move from conventional farming practices towards globally-recognized social and environmental sustainability practices.

3.3.4. ROLES OF GOVERNMENT REGULATION AND AGENCIES

The Vietnamese Government has and continues to play an important role in the prawn value chain to ensure prawn products comply with food safety requirements set by national regulations and importing countries (Tran et al., 2013a). The national body that has been governing the prawn industry is the MARD while DARD has been responsible for prawn farming industry at the provincial level. This study found that local governmental agencies that closely cooperated with ASC certification projects, such as DARDs, played an important role in governance of the production segment of the ASC value chain.

Interviews with local DARDs staff reported that performance standards required to meet national regulations, such as those for food hygiene and safety for seafood products, waste disposal, and effluent disposal, have been delivered to small-scale farmers through technical training, workshops, and field visits. The increasingly stringent approaches of DARDs towards monitoring prawn farming activities has been the result of stricter national regulatory standards for food safety and hygiene, and increased concern for social and environmental impacts, as well as the increasing stringency of certification scheme standards of importing countries. The DARDs were also proactive in working with seafood processors and NGOs in establishing value chains for prawn products from the inputs of PLs and chemicals to outputs of ASC certified products.

The increased importance of the Vietnamese national government in the governance of the prawn value chain was demonstrated by the issuing of VietGAP, which is voluntary for prawn farming in accordance with Decision 4835/QD-BNN-TCTS (MARD, 2015). Although VietGAP substantially covers a wide range of social, environmental, livelihood, food safety and traceability concerns (Marschke and Wilkings, 2014), it is not recognized internationally (Nguyen, 2015). Consequently, the application of VietGAP to prawn farming is considered a governance tool for improving the quality of prawns for domestic consumption, in which production sector food safety has been paid less attention historically (Nguyen et al., 2017b). In contrast, interviews with local DARDs staff revealed that both domestic and international markets did not require VietGAP certification, resulting in a lack of incentive for small-scale farmers to apply the program. However, as VietGAP prioritized the sustainable dimensions of prawn farming in local areas (Marschke and Wilkings, 2014), adoption of VietGAP could assist farmers in upgrading to international certification schemes more easily (Nguyen, 2015).

3.3.5. ROLES OF FARM CO-OPERATIVES AND THEIR GOVERNANCE STRUCTURES

As mentioned previously, small-scale prawn farmers integrated horizontally to form co-operatives which acted as large firms in the production segment of the value chain in order to obtain external support from government, NGOs, seafood processors, and other institutions (Anh et al., 2011; Phung and Pham, 2018). In 2012 in the Mekong Delta of Vietnam 155 aquaculture cooperatives were active, involving more than 336,000 farmers (MARD, 2012).

Interviews undertaken for this study found that the co-operatives were managed by a managerial board which represented all members for the purposes of monitoring production and certification activities of the co-operatives and dealing with external groups, such as seafood processors and local communities. Personnel of the managerial board varied between co-operatives but mainly included a Director, Deputy Directors, a Cashier, a Secretary, and Internal Inspectors/auditors. An example of one ASC co-operative managerial board is presented in Figure 5 and their basic responsibilities were summarized in Table 4.

Table 4: Summary of key responsibilities of each member in the ASC cooperative in Soc Trang province, modified from the "Quality Manual" of an ASC cooperative in Soc Trang

No	Sector	Key responsibility
1	Manager	Representation of the ASC cooperative for the purposes of signing contracts with other bodies. Progressing ASC implementation. General management activities of the cooperative.
2	Administrator	Managing ASC documents and documentation. Disseminating ASC requirements and guiding farmers in conducting ASC certification processes.
3	Secretary	Gathering documents and guidelines about ASC requirements Documenting and document record keeping. Complaint receiving from farmers and local communities.
4	Internal inspector	Work safety, social welfare of workers (if applicable), and activities of Worker Union.
5	Technician	Farming techniques in compliance with ASC certification. Training and guiding farmers in practices compliant with ASC certification.
6	Internal auditor	Routinely auditing the implementation of farmers towards ASC certification. Identifying non-compliance, supporting and monitoring farmers to conduct corrective activities for non-compliance criteria.

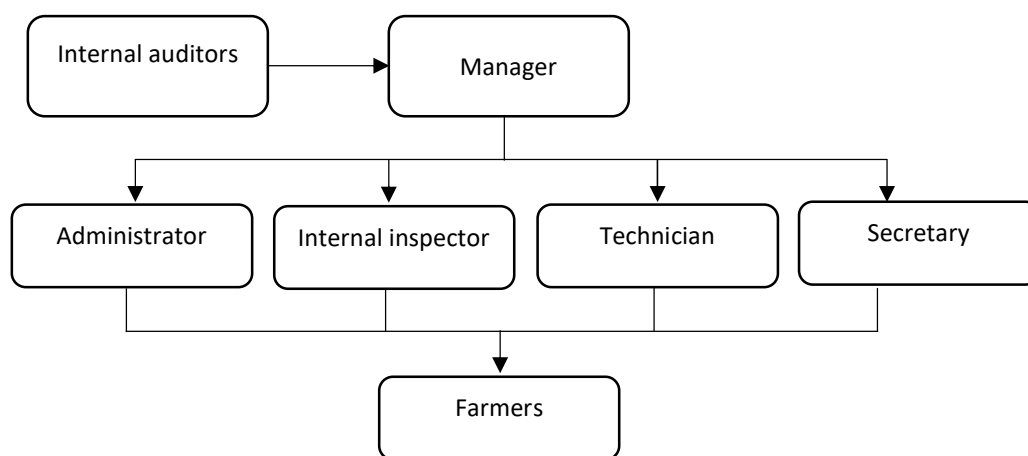


Figure 5: The structure of the managerial board of an ASC cooperative in Soc Trang province, adopted from the “Quality Manual” of the ASC cooperative.

Interviews with WWF-Vietnam and local DARDs revealed that co-operatives and the roles played by key personnel were a critical component of the production, ASC certification implementation, and governance aspects of the ASC prawn value chain which enabled small-scale farmers’ access to this chain and the benefits that flowed from it. This was reported by approximately 95% of the interviewed farmers. The co-operative was considered as a lead firm and the managerial board of the co-operative acted as a broker who represented all

members of co-operatives to ensure members implementing ASC requirements and producing bulk production and strengthen farmers' bargaining power with seafood processors in establishing contract farming and integrating of small-scale farmers into the ASC value chain.

4. CONCLUSION

The deployment of third-party certification such as ASC for small-scale prawn farmers in the Mekong Delta of Vietnam has been initiated in response to this buyer-driven global value chain and has yielded substantial improvements in specific areas of economic, environmental and social sustainability as well as successful integration of most participating small-scale farmers into the global value chain.

The ASC value chain comprised both the vertical linkages between actors involved in inputs, production, processing and markets, as well as the horizontal linkages between small-scale farmers in the production segment. Both of these types of linkages and the process of certification itself to enable access to the value chain generated a range of effects on the social, economic and environmental sustainability of small-scale prawn farming in the study area.

This study found that achievement of ASC certification facilitated access by most small-scale prawn farmers to the ASC global value chain via linkages through co-operatives and seafood processors, and that this functioned as a mechanism to distribute economic benefits to farmers through access to price premiums, improved livelihood through access to secure contract farming options, and improved social capital and capability for collective action through effective participatory governance structures. Vertical integration between farmers and other stakeholders (seafood processors, local DARDs, and NGOs) was found to be an important mechanism that enabled these beneficial effects. In addition, integration of farmers into the global value chain has been found to improve public profiles of farmers in internationally competitive markets (Blackman and Rivera, 2011), resulting in increased market access (Hatanaka and Busch, 2008).

5. ACKNOWLEDGEMENT

This study was funded by the University of Tasmania. Data was collected under a UTAS-WWF-VN internship agreement. The authors would like to acknowledge the contribution of Dr. Louise Adams and Assoc. Prof. John Purser, IMAS – Launceston, University of Tasmania, Australia for supporting for advice received in designing and conducting the study. The authors also would like to thank Mr. Tinh Huynh Quoc, Project Manager at WWF-Vietnam, for his support of data collection.

REFERENCES

- Ajani, E.K., Orisasona, O., Omitoyin, B.O., Osho, E.F., 2016. Total replacement of fishmeal by soybean meal with or without methionine fortification in the diets of Nile tilapia, *Oreochromis niloticus*. *Journal of Fisheries and Aquatic Science*. 11, 238-243.
- Alam, S.M.N., 2007. Biological and chemical products use in extensive shrimp farming in southwest Bangladesh. *Journal of Fisheries and Aquatic Science*. 2, 56-62.
- Alam, S.M.N., Pokrant, B., 2009. Re-organizing the shrimp supply chain: aftermath of the 1997 European Union import ban on the Bangladesh shrimp. *Aquaculture Economics & Management*. 13, 53-69.
- Anh, P.T., Dieu, T.T.M., Mol, A.P.J., Kroeze, C., Bush, S.R., 2011. Towards eco-agro industrial clusters in aquatic production: the case of shrimp processing industry in Vietnam. *Journal of Cleaner Production*. 19, 2107-2118.
- Anhalzer, G., Nanninga, R., 2014. Application of global value chains to seafood sustainability: lessons from the mahimahi industries of Ecuador and Peru. Master thesis. Duke University, USA.
- Bair, J., 2009. Global commodity chains: genealogy and review, in: Bair, J. (Ed.), *Frontiers of commodity chain research*. Stanford University Press, Stanford, California, pp. 1-34.
- Barmon, B.K., Chaudhury, M., Munim, S.S., 2011. Value chain and marketing channels of shrimp/prawn sector of gher farming system in Bangladesh. *World Review of Business Research*. 1, 10-24.
- Baumgartner, U., Nguyen, T.H., 2017. Organic certification for shrimp value chains in Ca Mau, Vietnam: a means for improvement or an end in itself? *Environment, Development and Sustainability*. 19, 987-1002.

- Blackman, A., Rivera, J., 2011. Producer-level benefits of sustainability certification. *Conservation Biology*. 25, 1176-1185.
- Bolwig, P., Ponte, S., du Toit, A., Riisgaard, L., Halberg, N., 2010. Integrating poverty and environmental concerns into value-chain analysis: a conceptual framework. *Development Policy Review*. 28, 173-194.
- Boyd, C.E., McNevin, A.A., Racine, P., Huynh, Q.T., Ngo, M.H., Viriyatum, R., Paungkaew, D., Engle, C., 2016. Resource use assessment of shrimp, *Litopenaeus vannamei* and *Penaeus monodon*, production in Thailand and Vietnam. *Journal of the World Aquaculture Society*, 201-226.
- Breukers, B., 2015. Are certification systems beneficial for farmers? An 'on-the-ground' comparison of co-existing sustainability standards in the Colombian coffee sector. Master thesis. Utrecht University, Utrecht, Netherlands.
- Briggs, M., Funge-Smith, S., Subasinghe, R., Phillips, M., 2004. Introductions and movement of *Penaeus vannamei* and *Penaeus stylirostris* into Asia and the Pacific. RAP Publication, Bangkok. pp. 92.
- Bui, N.P.T.C., 2011. The value chain of white leg shrimp exported to the U.S market in Khanh Hoa province, Vietnam. Master thesis. University of Tromso, Norway & Nha Trang University, Vietnam, Nha Trang.
- Bush, S., Oosterveer, P., 2015. Vertically differentiating environmental standards: the case of the Marine Stewardship Council. *Sustainability*. 7, 1861.
- Bush, S.R., 2018. Understanding the potential of eco-certification in salmon and shrimp aquaculture value chains. *Aquaculture*. 493, 376-383.
- Bush, S.R., Oosterveer, P., 2007. The missing link: intersecting governance and trade in the space of place and the space of flows. *Sociologia Ruralis*. 47, 384-399.
- Bush, S.R., Oosterveer, P., 2012. Linking global certification schemes and local practices in fisheries and aquaculture SPC Traditional Marine Resource Management and Knowledge Information Bulletin 29, 15-21.
- Bush, S.R., Belton, B., Hall, D., Vandergeest, P., Murray, F.J., Ponte, S., Oosterveer, P., Islam, M.S., Mol, A.P.J., Hatanaka, M., Kruijssen, F., Ha, T.T.T., Little, D.C., Kusumawati, R., 2013. Certify sustainable aquaculture? *Science*. 341, 1067-1068.
- Chayaburakul, K., Lightner, D.V., Sriurairattana, S., Nelson, K.T., Withyachumnarnkul, B., 2005. Different responses to infectious hypodermal and hematopoietic necrosis virus (IHHNV) in *Penaeus monodon* and *P. vannamei*. *Diseases of Aquatic Organisms*. 67, 191-200.
- Corsin, F., Funge-Smith, S., Clausen, J., 2007. A qualitative assessment of standards and certification schemes applicable to aquaculture in the Asia-Pacific region. RAP Publication, Bangkok, Thailand.
- De Schryver, P., Defoirdt, T., Sorgeloos, P., 2014. Early mortality syndrome outbreaks: a microbial management issue in shrimp farming? *PLoS Pathogens*. 10.
- Douma, M., van Wijk, J., 2012. ASC certified shrimp: can extensive shrimp farming benefit? A case study of Indonesia. Working paper No. 2012/46. Maastricht School of Management.
- Duijn, A.P.v., Beukers, R., Pijl, W.v.d., 2012. The Vietnamese seafood sector: a value chain analysis. CABI, The Netherlands.
- Flaherty, M., Samal, K.C., pradhan, D., Ray, S., 2009. Coastal aquaculture in India: poverty, environment and rural livelihood. Concept Publishing Company, New Delhi, India.
- Freitas, R.R.D., Martins, N.G., Poersch, L.H.D., 2014. Analysis of the marine shrimp farm production chain in Rio Grande Do Sul state. *Boletim de Industria Animal*. 71, 262-272.
- Gereffi, G., 1995. Global production systems and third world development, in: Stallings, B. (Ed.), *Global change, regional response: the new international context of development*. Cambridge University Press, Cambridge, pp. 100-142.
- Gereffi, G., 1999. International trade and industrial upgrading in the apparel commodity chain. *Journal of International Economics*. 48, 37-70.
- Gereffi, G., Fernandez-Stark, K., 2016. *Global value chain analysis: a primer (second edition)*. Center on Globalization, Governance and Competiveness, Social Science Research Institute, Duke University, Durham, NC.
- Golini, R., Caniato, F., Kalchsmidt, M., 2016. Linking global value chains and supply chain management: evidence from the electric motors industry. *Production Planning and Control*. 27, 934-951.
- Gräslund, S., Holmström, K., Wahlström, A., 2003. A field survey of chemicals and biological products used in shrimp farming. *Marine Pollution Bulletin*. 46, 81-90.

- Gutierrez, A., Thornton, T.F., 2014. Can consumers understand sustainability through seafood eco-labels? A U.S. and UK case study. *Sustainability*. 6, 8195-8217.
- Ha, T.T.T., Bush, S.R., Mol, A.P.J., van Dijk, H., 2012. Organic coasts? Regulatory challenges of certifying integrated shrimp–mangrove production systems in Vietnam. *Journal of Rural Studies*. 28, 631-639.
- Hatanaka, M., 2010. Certification, partnership, and morality in an organic shrimp network: rethinking transnational alternative agrifood networks. *World Development*. 38, 706-716.
- Hatanaka, M., 2014. Mcsustainability and Mcjustice: certification, alternative food and agriculture, and social change. *Sustainability*. 6, 8092-8112.
- Hatanaka, M., Busch, L., 2008. Third-party certification in the global agrifood system: an objective or socially mediated governance mechanism? *European Society for Rural Sociology*. 48, 73-91.
- Hav, V., Leap, H., 2005. Status of shrimp farming in Cambodia. *Regional Technical Consultation on the Aquaculture of P. vannamei and Other Exotic Shrimps in Southeast Asia*. SEAFDEC Aquaculture Department, Manila, Philippines. pp. 38-41.
- Henson, S., Humphrey, J., 2012. Private standards in global agri-food chains, in: Marx, A., Maertens, M., Swinnen, J.F.M. (Eds.), *Private standards and global governance: economic, legal and political perspectives*. Edward Elgar Publishing, Cheltenham, UK, pp. 98-113.
- Hien, N.T., Huong, N.T.L., Chuong, V.D.N., Quang, N.T.V., Hong, P., Hang, B.T.V., Long, N.V., 2016. Status of acute hepatopancreatic necrosis disease (AHPND) and other emerging diseases of penaeid shrimps in Viet Nam, in: Pakingking Jr., R.V., de Jesus-Ayson, E.G.T., Acosta, B.O. (Eds.), *Addressing Acute Hepatopancreatic Necrosis Disease (AHPND) and Other Transboundary Diseases for Improved Aquatic Animal Health in Southeast Asia: Proceedings of the ASEAN Regional Technical Consultation on EMS/AHPND and Other Transboundary Diseases for Improved Aquatic Animal Health in Southeast Asia*. Aquaculture Department, Southeast Asian Fisheries Development Center, Tigbauan, Iloilo, Philippines, pp. 88-95.
- Ho, T.M.H., Burny, P., 2016. Impact of value chain governance on the development of small scale shrimp farmers in Vietnam. *International Journal of Business and Economic Sciences Applied Research*. 9, 93-98.
- Holzapfel, S., Wollni, M., 2014. Is GlobalGAP certification of small-scale farmers sustainable? Evidence from Thailand. *The Journal of Development Studies*. 50, 731-747.
- Huntington, T.C., Hasan, M.R., 2009. Fish as feed inputs for aquaculture – practices, sustainability and implications: a global synthesis, in: M.R. Hasan, M. Halwart (Eds.), *Fish as feed inputs for aquaculture: practices, sustainability and implications*. FAO Fisheries and Aquaculture Technical Paper. No. 518, Rome, pp. 1-61.
- Jespersen, K.S., Kelling, I., Ponte, S., Kruijssen, F., 2014. What shapes food value chains? Lessons from aquaculture in Asia. *Food Policy*. 49, 228-240.
- Jonell, M., Phillips, M., Ronnback, P., Troell, M., 2013. Eco-certification of farmed seafood: will it make a difference? *Ambio*. 42, 659-674.
- Kagawa, M., Bailey, C., 2006. Trade linkages in shrimp exports: Japan, Thailand and Vietnam. *Development Policy Review*. 24, 303-319.
- Kelling, I., Young, J.A., 2010. Market dynamics and governance in global aquaculture value chains: chaining producers? IIFET 2010 Montpellier Proceedings.
- Larsen, H.B., 2014. Governance, quality conventions, and product innovation in a value chain: the case of the Spanish salted fish market. *Growth and Change*. 45, 412-429.
- Lavens, P., Sorgeloos, P., 2000. Experiences on importance of diet for shrimp postlarval quality. *Aquaculture*. 191, 169-176.
- Lestariadi, R.A., Yamao, M., 2017. Integrating risk management into business process models for small-scale shrimp industry in east Java, Indonesia. *American Journal of Rural Development*. 5, 144-150.
- Macfadyen, G., Phillips, M., Haylo, G., 2005. International seafood trade: supporting sustainable livelihoods among poor aquatic resource users in Asia (EP/R03/014). Output 3 Synthesis Report with Pro-Poor Trade Research Findings and Policy recommendations. Network of Aquaculture Centres in Asia-Pacific (NACA), and the STREAM Initiative. Support to Regional Aquatic Resources Management (STREAM), Bangkok, Thailand. pp. 69.

- MARD, 2012. Developing models for fishery cooperatives in building new rural areas in the Mekong Delta. <https://www.mard.gov.vn/Pages/phat-trien-mo-hinh-hop-tac-xa-thuy-san-trong-xay-dung-nong-thon-moi-vung-dong-bang-song-cuu-long-12955.aspx>, accessed 18 July 2018.
- MARD, 2015. Issue guidelines for the application of VietGAP standards for tiger shrimp (*P. monodon*) and white leg shrimp (*P. vannamei*). MARD, Hanoi.
- Marschke, M., Wilkings, A., 2014. Is certification a viable option for small producer fish farmers in the global south? Insights from Vietnam. *Marine Policy*. 50, 197-206.
- Mather, C., 2008. Value chains and tropical products in a changing global trade regime, ICTSD Project on Tropical Products, Geneva, Switzerland.
- Meyer, D.Z., Avery, L.M., 2008. Excel as a qualitative data analysis tool. *Field Methods*. 21, 91-112.
- Mostafa Shamsuzzaman, M., Kumar Biswas, T., 2012. Aqua chemicals in shrimp farm: A study from south-west coast of Bangladesh. *The Egyptian Journal of Aquatic Research*. 38, 275-285.
- Munasinghe, M.N., Stephen, C., Abeynayake, P., Abeygunawardena, I.S., 2010. Shrimp farming practices in the Puttallam District of Sri Lanka: implications for disease control, industry sustainability, and rural development. *Veterinary Medicine International*.
- Mwambi, M.M., Oduol, J., Mshenga, P., Saidi, M., 2016. Does contract farming improve smallholder income? The case of avocado farmers in Kenya. *Journal of Agribusiness in Developing and Emerging Economies*. 6, 2-20.
- Ngo, L.P.T., 2013. Social and ecological challenges of market-oriented shrimp farming in Vietnam. SpringerPlus. 2.
- Nguyen, T.A.T., Bui, C.T.P.N., Jolly, C.M., 2017a. The value chain of exported whiteleg shrimp: case study in Khanh Hoa province, Vietnam. *International Journal of Food and Agricultural Economics*. 5, 9-23.
- Nguyen, T.B.T., 2015. Good aquaculture practices (VietGAP) and sustainable aquaculture development in Viet Nam, in: Romana-Eguia, M.M.R., ParadoEstepa, F.D., Salayo, N.D., Lebata-Ramos, M.J.H. (Eds.), *Resource Enhancement and Sustainable Aquaculture Practices in Southeast Asia: Challenges in Responsible Production of Aquatic Species: Proceedings of the International Workshop on Resource Enhancement and Sustainable Aquaculture Practices in Southeast Asia 2014 (RESA)*. Aquaculture Dept., Southeast Asian Fisheries Development Center, Tigbauan, Iloilo, Philippines, pp. 85-92.
- Nguyen, V.H., Tran, T.T.H., Unger, F., Dang, X.S., Grace, D., 2017b. Food safety in Vietnam: where we are at and what we can learn from international experiences. *Infectious Diseases of Poverty*. 6, 39.
- Omoto, R., 2012. Small-scale producers and the governance of certified organic seafood production in Vietnam's Mekong Delta. PhD thesis. University of Waterloo, Waterloo, Ontario.
- Ose, S.O., 2016. Using excel and word to structure qualitative data. *Journal of Applied Social Science*. 10, 147-162.
- Phillips, M., Subasinghe, R., Clausen, J., Yamamoto, K., Mohan, C.V., Padiyar, A., Funge-Smith, S., 2007. Aquaculture production, certification and trade: challenges and opportunities for small-scale farmers in Asia, in: Arthur, R., Nierentz, J. (Eds.), *Global Trade Conference on Aquaculture*. FAO Fisheries Proceedings No. 9, Qingdao, China, pp. 165-172.
- Phung, H.G., Pham, D.B., 2018. Effects of integrated shrimp farming in Vietnam. *Journal of the World Aquaculture Society*. 49, 664-675.
- Portley, N., 2016. SFP report on the shrimp sector: Asian farmed shrimp trade and sustainability. Sustainable Fisheries Partnership Foundation. pp. 22.
- Ragasa, C., Lambrecht, I., Kufolalor, D.S., 2018. Limitations of contract farming as a pro-poor strategy: the case of maize outgrower schemes in upper West Ghana. *World Development*. 102, 30-56.
- Rich, K.M., Ross, R.B., Baker, A.D., Negassa, A., 2011. Quantifying value chain analysis in the context of livestock systems in developing countries. *Food Policy*. 36, 214-222.
- Sausman, C., Garcia, M., Fearn, A., Felgate, M., Mekki, A.A.E., Cagatay, S., Soliman, I., Thabet, B., Thabet, C., Saïd, M.B., Laajimi, A., Ashkar, H.A., Hadad-Gauthier, F.E., Mili, S., Martínez, C., 2015. From value chain analysis to global value chain analysis: fresh orange export sector in Mediterranean partner countries, in: Petit, M., Montaigne, E., El Hadad-Gauthier, F., García Álvarez-Coque, J.M., Mattas, K., Mili, S. (Eds.), *Sustainable Agricultural Development: Challenges and Approaches in Southern and Eastern Mediterranean Countries*. Springer International Publishing, Cham, pp. 197-225.

- Schouten, G., Vellema, S., Wijk, J.v., 2016. Diffusion of global sustainability standards: the institutional fit of the ASC-Shrimp standard in Indonesia. *RAE-Revista de Administração de Empresas*, 411-423.
- Senapin, S., Phiwsaiya, K., Gangnonngiw, W., Flegel, T.W., 2011. False rumours of disease outbreaks caused by infectious myonecrosis virus (IMNV) in the whiteleg shrimp in Asia. *Journal of Negative Results in Biomedicine*. 10, 1-10.
- Setboonsarng, S., Leung, P., Cai, J., 2006. Contract farming and poverty reduction: the case of organic rice contract farming in Thailand. ADB Institute discussion paper no. 49. Asian Development Bank Institute, Tokyo.
- Shields, J.D., Hajek, A.E., 2018. Prevention and management of infectious diseases in aquatic invertebrates, in: Ann E. Hajek, David I. Shapiro-Ilan (Eds.), *Ecology of Invertebrate Diseases*. John Wiley & Sons, pp. 527-585.
- Stickney, R.R., 2005. *Aquaculture: an introductory text*, 3rd ed. CABI, Texas, USA.
- Swartz, W., Schiller, L., Rashid Sumaila, U., Ota, Y., 2017. Searching for market-based sustainability pathways: challenges and opportunities for seafood certification programs in Japan. *Marine Policy*. 76, 185-191.
- Tacon, A.G.J., Jory, D., Nunes, A., 2013. Shrimp feed management: issues and perspectives, in: New, M.B. (Ed.), *On-farm feeding and feed management in aquaculture*. FAO Fisheries and Aquaculture Technical Paper No. 583. FAO, Rome, pp. 481-488.
- Tran, N., Bailey, C., Wilson, N., Phillips, M., 2013a. Governance of global value chains in response to food safety and certification standards: the case of shrimp from Vietnam. *World Development*. 45, 325-336.
- Tran, N.H., Pham, M.D., Vo, N.S., Truong, H.M., Nguyen, T.P., 2015. Innovation in seed production and farming of marine shrimp in Vietnam. *World Aquaculture*. 46, 32-37.
- Tran, T.P.H., van Dijk, H., Bosma, R., Le, X.S., 2013b. Livelihood capabilities and pathways of shrimp farmers in the Mekong Delta, Vietnam. *Aquaculture Economics & Management*. 17, 1-30.
- Tran, T.T.H., Bush, S.R., 2010. Transformations of Vietnamese shrimp aquaculture policy: empirical evidence from the Mekong Delta. *Environment and Planning C: Government and Policy*. 28, 1101-1119.
- Tran, T.T.H., Bush, S.R., Mol, A.P.J., van Dijk, H., 2012. Organic coasts? Regulatory challenges of certifying integrated shrimp-mangrove production systems in Vietnam. *Journal of Rural Studies*. 28, 631-639.
- Tran, V.N., 2004. Responsible shrimp farming in Vietnam: call for promoting and strengthening community based management approaches. Tokyo, Japan. International Institute of Fisheries Economics & Trade.
- Van, T.B., Bao, T.L., 2017. The sustainable shrimp supply chain in the Mekong Delta, Vietnam. *International Journal of Advanced Scientific Research and Management*,. 2, 84-90.
- Vandergeest, P., 2007. Certification and communities: alternatives for regulating the environmental and social impacts of shrimp farming. *World Development*. 35, 1152-1171.
- VASEP, 2018. Report on Vietnam shrimp export 2008-2017. Vietnam Association of Seafood Exporters and Producers, Hanoi, Vietnam. pp. 31.
- Vincent, A.G., Lotz, J.M., 2007. Advances in research of necrotizing hepatopancreatitis bacterium (NHPB) affecting Penaeid shrimp aquaculture. *Reviews in Fisheries Science*. 15, 63-73.
- Warning, M., Key, N., 2002. The social performance and distributional consequences of contract farming: an equilibrium analysis of the Arachide de Bouche program in Senegal. *World Development*. 30, 255-263.
- Washington, S., Ababouch, L., 2011. Private standards and certification in fisheries and aquaculture: current practice and emerging issues., FAO Fisheries and Aquaculture Technical Paper 553. FAO, Rome, pp. 181.
- WWF, 2016. WWF brings shrimp products from 52 small-scale shrimp farmers to international markets through ASC certification and public-private partnership.
- WWF, IDH, 2014. ASC shrimp standard, version 1.0 March 2014. Aquaculture Stewardship Council (ASC), Utrecht, The Netherlands, pp. 144.
- Zach, L., Doyle, M.E., Bier, V., Czuprynski, C., 2012. Systems and governance in food import safety: a U.S. perspective. *Food Control*. 27, 153-162.
- Zander, K., Feucht, Y., 2018. Consumers' willingness to pay for sustainable seafood made in Europe. *Journal of International Food & Agribusiness Marketing*. 30, 251-275.