Value Chain Upgrading: Evidence from the Singaporean Aquaculture Industry

Lim, Guanle

2016

Lim, G. (2015). Value chain upgrading: Evidence from the Singaporean aquaculture industry. *Marine Policy*, 63, 191-197.

<https://hdl.handle.net/10356/83109>

<https://doi.org/10.1016/j.marpol.2015.03.016>

© 2015 Elsevier Ltd. This is the author created version of a work that has been peer reviewed and accepted for publication by *Marine Policy*, Elsevier. It incorporates referee's comments but changes resulting from the publishing process, such as copyediting, structural formatting, may not be reflected in this document. The published version is available at: [<http://dx.doi.org/10.1016/j.marpol.2015.03.016>].

Downloaded on 26 Apr 2023 18:10:20 SGT

Value Chain Upgrading: Evidence from the Singaporean Aquaculture Industry

Abstract:

This paper examines the Singaporean aquaculture industry using an integrated perspective that draws on the global value chain and global production network approaches. The paper focuses especially on the upgrading efforts of the fish farming firms operating at the industry's upstream node. Based on research and qualitative personal interviews with firms involved in the Singaporean aquaculture industry, this paper argues that the city-state's wider institutional context – dirigisme in governing the utilization of land and sea space, and commitment to a liberalized trade regime to feed its populace – complicates the upgrading efforts of the fish farming firms. Notwithstanding the inherent complexities of economic upgrading per se, such findings prove that while upgrading is an effort driven by the firm and its cohort of stakeholders, the effort is unlikely to succeed if the broader institutional and regulatory environment that the firms are embedded in is not conducive.

Keywords: aquaculture, global commodity chains, global production networks, global value chains, Singapore, upgrading

Highlights

- Analysis of the upgrading efforts of fish farming firms in Singapore.
- Singapore's institutional context complicates the upgrading efforts of the firms.
- An integrated global value chain and global production network approach.

1.0 Introduction

Contributing close to half of total world fisheries output in 2011 (FAO, 2012), aquaculture is widely heralded as the world's faster growing food production sector. This is particularly so in poverty-stricken regions such as Vietnam's Mekong Delta and Bangladesh's greater Khulna region which rely on the export-oriented production and marketing of prized aquaculture commodities as a growth strategy (Duval-Diop and Grimes, 2005; Saidul Islam, 2008). Despite its economic importance, there is still a relative paucity of research on aquaculture from the standpoint of economic geography, especially vis-à-vis the better-understood value chain research concerning the industrial goods and the broader agro-food sector. Such analysis is particularly lacking for places that are *not* major aquaculture producing regions. To this end, minor aquaculture producing places such as Singapore is an under-researched area vis-à-vis the major aquaculture producing places e.g. the aforementioned Mekong Delta and the greater Khulna region (e.g. Belton, 2012; Belton *et al.*, 2012; Kagawa and Bailey, 2006). For Singapore, the lack of research does not negate the importance of this industry. The vitality and sustainability of this industry is especially important for Singapore's food resilience efforts as the tiny city-state, with a land area of only 714 km², grapples with the dilemma of cultivating versus buying its food supply (with food fish as one of the core components) (see AVA, 2011; Ngiam and Cheong, 2006). These concerns motivate this paper's investigation of how well the Singaporean fish farming firms have coped with Singapore's inherent lack of space, and an increasingly smaller space for their farming activities. The paper also investigates the relationship between state policies (such as those pertaining to land use and international trade) and the dynamics of the aquaculture value chain for it affects the upgrading opportunities for firms involved in the chain. This relationship, while clearly influenced by the agency of firms and interfirm

dynamics, is also dependent on contextual factors that shape the geography and configuration of the value chain.

With the above as a backdrop, this paper examines the Singaporean aquaculture industry using an integrated perspective that draws on the global value chain (GVC) and global production network (GPN) approaches. The paper analyzes the role that the institutional and structural environment of Singapore plays in influencing the upgrading opportunities available to the fish farming firms operating at the upstream node. It also argues that the city-state's wider institutional context – strict policy in governing the utilization of land and sea space, and commitment to a liberalized trade regime to feed its populace – complicates the upgrading efforts of the fish farming firms.

The following section discusses some of the central insights yielded by theoretical work in the GVC and GPN approaches. It also identifies a knowledge gap in the corpus of scholarship detailing the aquaculture industry. Specifically, there is a lack of research on the relationship linking upgrading opportunities of aquaculture firms (especially the subordinate firms) and the broader dynamics of their respective value chains. Section 3.0 offers an analysis of Singapore's state-society relations and their broader relationship to aquaculture development, highlighting that while the Singaporean state has been successful in cultivating a prosperous economy within a short period, it also inadvertently bypassed its small and less productive farming firms, many of which are active players in agriculture (and by extension, aquaculture). These insights – the focus on Singapore's socioeconomic history and place-specific embeddedness – add nuance to the paper. Section 4.0 describes the research methodology before the findings from the interview sessions are presented and discussed in greater depth in Section 5.0. The penultimate section of the paper summarizes the main arguments, underlining that while upgrading is an effort primarily driven by firms, the effort is unlikely to materialize if the broader institutional environment is not conducive. In other

words, Singapore's strict policy in governing the utilization of space and commitment to a liberalized trade regime to feed its populace has complicated the upgrading efforts of the firms. It also offers policy advice to alleviate some of the problems faced by the aquaculture firms, illustrating the merits of establishing a lobby group to address common good issues.

2.0 GVCs, Upgrading and Aquaculture

Building upon concepts from the global commodity chain (GCC) approach, the GVC approach is centered upon four key dimensions: an input-output structure, territoriality, a governance structure (Gereffi, 1994), and an institutional framework (Gereffi, 1995). The *input-output structure* and the *territoriality* of the GVC are used to delineate the distribution of value-added and spatial configuration of a sequence of economic activities. The *governance structure* determines the relations of power that arbitrate resource allocation along the value chain. The *institutional framework* identifies how local, national, and international conditions and policies shape the globalization process at each stage in the chain. Of these four dimensions, the governance structure has received the most attention (see Gibbon, 2001; Henderson *et al.*, 2002; Sverrisson, 2004) because of its attention to the organizational aspects of international trade, and the power relations influencing the activities from primary production to the final consumption.

The concept of governance is especially insightful for it determines the upgrading opportunities – processes enabling firms (especially those in developing countries) to improve their positions in particular value chains – for actors involved in the GVC (Bair, 2005). Three types of upgrading have since been identified: economic, social, and environmental (see De Marchi *et al.*, 2013; Rossi, 2013). Economic upgrading has received the most attention thus far because many GVC researchers are influenced by comparative development and international business literature. Therefore, it is not surprising that they

place the firm as the main object of analysis. For these researchers, economic upgrading occurs through intra-chain or functional upgrading (moving up the same value chain from a more marginal to a more secure position when a firm increases the range of functions performed), product upgrading (producing more sophisticated goods with higher unit prices), process upgrading (improving technology and/or production systems), and inter-chain upgrading (moving from one industry to another) ([Humphrey and Schmitz, 2001](#)). However, the economic upgrading narrative is increasingly challenged as a more multidimensional viewpoint on this subject has emerged in recent years ([Lim and Neo, 2014](#)). More specifically, [Challies \(2008\)](#) argues that it is imperative to engage with the actors at the roots of the value chains to understand the local implications of chain dynamics in terms of the distribution of opportunities and challenges. He further stresses that the conditions under which upgrading occur are highly variegated and largely contingent on local factors.

A survey of existing GVC research on the broader agro-food industry shows that the value chains of many of the products are dominated by large and well-capitalized “buyers” (typically retailers and traders from the developed world), with minimal upgrading opportunities for the subordinate firms. For instance, the coffee ([Ponte, 2002](#)) and fresh vegetable ([Dolan and Humphrey, 2000](#)) industries display strong tendencies of a buyer-driven chain. Similarly, GVC research on the aquaculture industry have illustrated that lead firms in developed countries, leveraging on their financial might and buying volume, exercise disproportionate control over the other actors (not limited to fish farming firms in developing countries) (see [Bush and Duijf, 2011](#); [Saidul Islam, 2008](#); [Wilkinson, 2006](#)). On some occasions, the actions of the lead firms have also led to environmental degradation as well as labor insecurity at the farming sites ([Barton and Fløysand, 2010](#); [Vandergeest, 2007](#)). Nevertheless, this does not necessarily mean that the subordinate firms are powerless in devising strategic options (such as upgrading) to soften or even counter the market power of

the lead firms. Research conducted within the GPN tradition – which evolved in dialogue with, and as critique of, the GVC approach – highlights the need to “appreciate the importance of different institutional and regulatory contexts that shape international production systems” (Bair, 2008: 355). While the GPN approach appreciates the crucial role played by lead firms and the resultant interfirm dynamics (a key concern of the GVC approach), it also emphasizes the broad range of actors such as trade unions and governments that collectively shapes global production, and by extension upgrading opportunities (Coe, 2011; Coe *et al.*, 2004). In other words, value chains link not only firms in different locations, but also the embeddedness – though to varying extents – of such firms at the society, network, and territory levels (Hess and Coe, 2006). For instance, Norway’s predominantly social democratic regimes (and their commitment to the welfare state) have consistently enacted policies that favor small scale fish farming firms over capital, leading to decentralized local ownership and geographic dispersion within the Norwegian salmon aquaculture industry (Phyne, 2010). Until relatively recently, the Norwegian government has passed legislations that permitted only limited economic concentration, safeguarding the many small scale rural salmon farming firms that reside along its dispersed coastline, and providing them with ample avenue to upgrade their operations (Phyne *et al.*, 2006). Another example can be seen in the state-sponsored introduction of the bighead carp (a native species of China) into the Philippines, and the fish’s subsequent popularization among the Filipino public (Saguin, 2014). Recognizing the bighead carp’s tolerance of poor water conditions, the Filipino state had introduced the fish into the Laguna Lake (a highly eutrophic freshwater body located at the southeast of Metro Manila) to provide a steady supply of food to feed the burgeoning population of Metro Manila, Southeast Asia’s second largest megacity. Furthermore, the state has (correctly) proposed the cultivation of the bighead carp as an efficient solution to address declining yields in the capture fisheries sector, improve incomes of the fish farming

community, and tap the underutilized potentials of converting abundant nutrients (of the Laguna Lake) to fish.

In spite of the insights from the above body of scholarship, the aquaculture value chain remains relatively under-researched vis-à-vis the better-understood value chains of the industrial goods (e.g. [Yeung, 2007](#)) and other agro-food products (e.g. [Fold, 2002](#); [Gwynne, 2006](#)). To put it another way, the aquaculture value chain is still a comparatively “raw” domain (see also [Belton and Bush, 2014](#)). Crucially, the relationships linking upgrading opportunities of aquaculture firms (especially the subordinate firms from developing countries) and the political economic dynamics embedded within their respective value chains have not been researched extensively. This paper’s examination of the value chain of the Singaporean aquaculture industry is a step towards uncovering these relatively under-researched intricacies. The paper focuses particularly on the fish farming firms operating at the upstream node of the value chain, analyzing the upgrading opportunities available to them and how they exploit such avenues. Integrating the perspectives of the GVC and GPN traditions, the paper unpacks the economic upgrading of these firms and how their upgrading efforts are influenced by the wider institutional factors.

3.0 An Overview of the Singaporean Aquaculture Industry

Singapore’s economic progress since its separation from Malaysia in 1965 is spectacular ([Low, 2001](#); [Shin, 2005](#)). Much of this success is attributed to the city-state’s government which plays a prominent role in implementing effective socioeconomic policies. Its success in the early decades was predominantly based on the strategy of phasing out the weaker portion of the private sector and investing heavily in human resource development to build a skilled labor force for the foreign multinational companies (MNCs) and government-linked companies (GLCs) in a two-legged policy ([Chan and Ng, 2004](#); [Dahles, 2008](#)). At that time,

the private sector was primarily made up of labor-intensive companies, many of which were ethnic Chinese family firms. These firms were perceived to be “dragging the economy down in terms of low productivity and intensive use of labor resources in the wake of severe labor shortage at that time” (Chan and Ng, 2000: 294). Subsequently, these firms were either displaced or had to subcontract their services to the foreign MNCs or the GLCs (Low, 1990). Despite a conscious shift to promote the growth of the non-GLC private sector starting from the 1990s, the Singaporean economy remains largely reliant on the MNCs and the GLCs (see also [Tan and Yeung, 2000](#)).

However, Singapore’s emphasis on the MNCs and the GLCs meant that certain sectors of the economy, particularly the less productive and space-consuming agricultural sector, were side-lined. Singapore’s economic strategy, along with the political elites’ focus on solving the twin problems of unemployment and housing, lead to the conversion of vast tracts of agricultural land for industrial and housing purposes. The breakneck speed of this development is reflected in the broader economy as the entire primary sector (agriculture, fishing, and quarrying) accounted for only 1.3% of the country’s gross domestic product (GDP) in 1980, a mere 15 years since Singapore’s independence (Hill, 2013). The diminishing economic contribution of Singapore’s agriculture sector can also be seen in the greatly reduced availability of farmland – from 13,000 ha in the 1970s, 8,000 ha in the 1980s, to 1,500 ha in the 2000s (Ngiam and Cheong, 2006). Such a development was made possible by a strong political system, which granted the government wide powers to acquire and allocate any land it considers necessary for the fulfillment of public projects (De Koninck, 1973; Government Publications Bureau, 1966). As De Koninck (1973: 106) further specifies, these projects “range from schools, hospitals and community centers to drainage schemes, roads and, most important, housing and industrial estates”.

The transformation, both in the economy and the physical space, also had the side-effect of displacing Singapore's agricultural community, with its predominantly ethnic Chinese farming firms paying the "price" of the Singapore economic miracle (see De Koninck, 1973). Many of these farming firms did not possess the financial capability or technological know-how of the MNCs and the GLCs, deficiencies that hastened their displacement. Underlying this process was the normative force captured by Campbell and Marshall's (2002: 163) postulation that "the legitimization of planning has... rested on the proposition that the state's intervention in land and property development is necessary to safeguard public interest". [Neo \(2007\)](#) problematizes the definition of "public interest". For him, "'public' or 'collective' interest compels the minority to yield to the will of the majority in land-use development matters and the will of the majority is frequently driven by economic profit and 'efficiency'" (Neo, 2007: 189). Yet, until relatively recently, dissenting voices have largely been marginalized by the political elites' claims to have safeguarded economic growth.

As Singapore's agricultural activities diminished over the years, the government body in charge of developing and regulating the local farming and fishing industry, the Agri-Food and Veterinary Authority (AVA), underwent a major transformation as it moved beyond its traditional role by taking on new functions e.g. food safety testing and facilitation of agri-trade. In addition, the AVA carried out a major review of the future of agriculture in 1984 to maintain a degree of food self-sufficiency and maximize land productivity (AVA, 2013b; Ngiam and Cheong, 2006). It was determined that if agricultural land shrank at the previous rate, farming could be phased out completely within 10 to 20 years. Such an outcome would negatively impact the livelihood of about 23,000 farmers and farm workers (Ngiam and Cheong, 2006). Moreover, capabilities related to domestic food production and ornamental agriculture e.g. orchid and fish cultivation would be hollowed out. In view of these

implications, the city-state formulated a strategy to sustain the farming industry in 1985. This strategy led to the development of six agrotechnology parks “designed for intensive farming systems and for an aesthetic and nonpollutive [sic] environment which would blend into the urban environment. This allowed for farming within the city or urban farming” (Ngiam and Cheong, 2006: 10-11). Subsequently, 1,500 ha of land was identified and developed into six agrotechnology parks located at Lim Chu Kang, Murai, Sungei Tengah, Nee Soon, Mandai and Loyang respectively. To boost the performances of these agrotechnology parks, the Singaporean state invested in infrastructure provisioning e.g. supplying water, electricity, drainage and telecommunication services in these six agrotechnology parks. It also encouraged private sector development by leasing land parcels (from two to 20 ha) to interested parties (Ngiam and Cheong, 2006). At present, there are over 200 farms operating inside these six parks for the production of livestock, eggs, milk, aquarium and food fish, vegetables, fruits, orchids, ornamental and aquatic plants, as well as for the breeding of birds and dogs (AVA, 2013a). All of these plots are placed on an unsubsidized and fully commercial footing (Liew, 1985). In addition, the farms must also meet production quotas, or risk losing the sites.

For the fish farming firms, their operations are relatively simplified as they concentrate their efforts almost exclusively on fish cultivation (from fingerlings) and harvesting upon maturity. Likewise, other upstream (i.e. hatching of fish from eggs and grow-out of fingerlings) and downstream (i.e. processing and marketing) activities further up and down the farming value chain are not carried out by them (see Chou, 1986; Ngiam and Cheong, 2006). The most expensive component of their operating cost is the feed cost (about 70% of total operating cost). Many of these firms also appear to be labor-intensive with minimal automation. Their main pool of labor is derived from the owners and his or her family members. A typical fish farm also employs less than 20 workers, even when seasonal

workers are included. The types of products farmed in Singapore include a variety of salt and fresh water fish, with tilapia, sea bass, groupers, mullets, and pomfrets the more popular options (see Chou, 1986; Liew, 1985). Most of the farm products are harvestable only over an average cultivation period of six months (from fingerlings to adult fish). Often times, the fish farming firms have to make a choice between fattening the adult fish further versus selling them as quickly as possible to ease the cash flow of their firms. Much like the agriculture sector, the aquaculture industry is equally affected by the general contraction of agricultural land taking place across Singapore. Subject to the same forces, aquaculture production has decreased following land reclamation efforts from the state. This has particularly affected the land based fish farms that practice mixed farming (a common feature until the late 1980s) as they are forced to cultivate a much narrower range of farm produce in a less spacious surrounding (Liew, 1985). Nevertheless, the scarcity of space has not triggered a corresponding rise in productivity, forcing Singapore to import its food fish supply, with the bulk of it originating from Malaysia, Taiwan, and Thailand ([Tey *et al.*, 2009](#)). As can be seen in Table 1, Singapore has produced only 3.3 to 4.8% of its food fish supply from 2007 to 2012. Within the domestic food fish industry, the aquaculture industry accounts for a major share of the supply as the local fishing fleet harvesting wild fisheries has downsized considerably. More broadly, as of 2012, the low food fish self-sufficiency level mirrors the meager domestic production levels of two other key food items, namely eggs and leafy vegetable (see Figure 1).

[Insert Table 1]

[Insert Figure 1]

To ease some of the pressure of land space constraint, many domestic food fish farming firms have resorted to cultivating their fish stock off the sea waters surrounding

Singapore. A recent government survey highlights that 95 out of a total of 111 (85%) aquaculture farms are concentrated at four sites along the Johor Straits: Lim Chu Kang, Ponggol, Serangoon/Loyang, and Pulau Ubin (AVA, 2011). These sites have been specifically selected by the AVA, in consultation with the Ministry of the Environment and Water Resources (MEWR), for availability of sheltered waters for coastal fish farming and water quality standards that are in line with international standards for fish farming. They are also kept away from the major navigational routes as a precautionary measure against possible collisions with sea vessels ([Chou and Lee, 1997](#)). As a result of Singapore's position as one of the world's busiest shipping hubs, coastal food fish farming is inherently limited by the competition for sea space, namely for navigational and commercial purposes ([Chou and Lee, 1997](#)). To alleviate the sea space constraint, the Singaporean state has encouraged the food fish farming firms (both on land and on sea) to increase their capability and productivity levels to maximize the limited space that Singapore has for local farming. The AVA also helps the fish farming firms identify problems that hinder production and to develop improvement plans such as the adoption of more advanced farming technology (AVA, 2011). For the sea farms, one of the most pragmatic measures involves the establishment of large industrial farming systems utilizing deep net cages similar to those employed in the highly successful Norwegian salmon farming system (see also [Phyne *et al.*, 2006](#)). Chou and Lee (1997) postulate that such a farming system can be located far from coastal activities, utilizing more of the vertical water column than sea area. They further assert that this would be a more sustainable option for aquaculture development in Singapore in the near future. To this end, a state-led program began in 1997 with the establishment of a sea bass farm in a site off St. John's Island. On balance, this project has enjoyed some success as it has produced several species of tropical food fish. However, the project's feasibility and sustainability have

also been hampered by the lack of a consistent supply of good quality fish fry (Ngiam and Cheong, 2006).

Apart from the space and technical constraints surrounding food fish cultivation, many of the Singaporean fish farming firms face intense competition from more competitively priced food fish from abroad, especially those with a cheaper currency and a lower labor cost. Their predicament is worsened as Singapore's liberalized trade regime meant that the domestic food fish farming firms are not able to rely on import tariffs or other non-tariff barriers to shield their products (see also Hill, 2013; Lim, 2013). In other words, they are sandwiched by a less than conducive domestic environment and intense competition from foreign products. As De Koninck (1992) asserts, many of these firms have responded to these pressures by either quitting the trade altogether, or to contract out part or all of their food production abroad, or to invest in food production activities in the neighboring regions of Johor (Malaysia) and the Riau Islands (Indonesia), with the end products sent back to the city-state.

4.0 Methods

This paper used a qualitative personal interview method to collect and analyze data on the aquaculture value chain of Singapore. Before the interviews and fieldwork were undertaken, preliminary explorations were conducted. Data was compiled from newspaper and magazine articles, the internet, and through personal contacts. This took place from January to May 2013. Subsequently, an initial list of 238 firms – covering the entire length of the value chain – was identified. The firms were approached from May to June 2013. After multiple follow-ups, 66 respondents agreed to be interviewed. Of these 66 respondents, there were 18 (out of 100) farming firms, 10 (out of 49) wholesalers, 6 (out of 11) retailers, and 32 (out of 78) wet market stallholders and eateries respectively.

Semi-structured interviews with these respondents were conducted from June to December 2013, with a focus on two main topics: (i) their overall business strategy and position in the value chain; and (ii) the upgrading opportunities available (especially to the fish farming firms at the upstream node) and how such opportunities relate to their wider institutional context. The goal of these interviews was to determine and map an overall view of the Singaporean aquaculture value chain. More specifically, these interviews unearthed the ambitions and actual steps taken by the fish farming firms to upgrade their activities, with particular reference to the context of their industry and its broader political economy. The interview sessions were conducted in either the firms' headquarters in Singapore and/or their overseas operations.

To supplement the primary data provided by these firms, their responses were used in conjunction with information from published sources such as annual reports and company websites (if available), and non-published sources such as interviews with other parties that were familiar with the operations of the firms involved e.g. business analysts and journalists. The use of these sources of information allowed for data verification and triangulation, which helped to improve data accuracy. Since several of the themes discussed, mainly business-state interactions, are considered sensitive in Singapore, the interviewees were promised confidentiality. Therefore, this paper does not refer to any entities by their original names. The names of the owners and managers of the firms surveyed were also altered to protect their identity.

5.0 The Upgrading Process of the Fish Farming Firms

This section focuses on the fish farming firms at the upstream node of the value chain, and examines their experiences with *economic upgrading*. It specifically investigates the struggles that the fish farming firms face in their upgrading endeavors, and how these issues

are related to Singapore's socioeconomic contours and institutional environment. Although the Singaporean fish farming firms have inserted themselves into the aquaculture value chain courtesy of their link up with the wholesalers and retailers at the downstream node of the chain, it is not clear whether the former have reaped the supposed rewards of this buying arrangement. More crucially, while existing research on aquaculture activities in other countries (e.g. Norway) reveals that integration to value chains has encouraged a considerable portion of the fish farming firms to upgrade their activities (see [Phyne, 2010](#); [Phyne et al., 2006](#)), the findings of this paper do not provide evidence of such a development. While some of the firms have been able to upgrade by investing in more advanced fish rearing technology, they are the exception rather than the rule (Interview 10/12/2013). One of such exception is firm F2, which have successfully introduced the saltwater-tolerant tilapia.¹ F2's managing director developed this breed of tilapia via multiple rounds of trial-and-error, along with the technical input of some local researchers and the encouragement of the AVA.² The introduction of this breed of tilapia has been successful thus far as the tilapia has been well-received by the economic actors further down the value chain. According to the managing director of F2, the saltwater-tolerant version of the tilapia sells better versus its freshwater version because it has a clean taste, unlike the muddy taste that accompanies the freshwater tilapia (Interview 10/12/2013). More importantly, this breed of tilapia is also able to garner higher unit revenue and higher unit profit compared to the freshwater version. In other words, F2 has successfully achieved *product upgrading* (see [Humphrey and Schmitz, 2001](#)). Another firm that has upgraded its operations is Ah Hua Kelong.³ According to Wee (2014), the firm has introduced an online webpage offering a selection of food fish cultivated at its fish farm

¹ Tilapia is a freshwater fish inhabiting shallow streams, ponds, rivers, and lakes. In exceptional circumstances, the fish can be found in brackish water.

² He was not able to reveal the exact nature and the absolute figures of the support because of competitive reasons.

³ This firm was not interviewed despite attempts to approach its management. Unlike the other interviewees in this paper, Ah Hua Kelong's identity is revealed as all of the information regarding it is derived from secondary sources

to prospective buyers at the final node of the chain. Nevertheless, Ah Hua Kelong still cannot compete on the basis of price because it lacks the economies of scale and organizing ability of the other players further downstream of the value chain. Notwithstanding this disadvantage, Ah Hua Kelong has managed to capture a relatively niche domestic market share as it targets domestic consumers that are willing to pay more for convenience, freshness, and a more personal touch (Wee, 2014). In its unorthodox move to bypass the wholesalers at the intermediate node of the chain, Ah Hua Kelong has disrupted the existing chain hierarchy, reaping the fruits of *functional upgrading* (see [Bair, 2005](#)). However, the sustainability of this strategy cannot be verified at this stage as it has only started offering this service in April 2014.

Overall, feedback from the interviewees suggests that the Singaporean fish farming firms find it difficult to upgrade their operations largely as a result of Singapore's unique physical geography and state-society relations i.e. the state's dirigisme in spatial development and commitment to a liberalized trade regime to feed its populace. Nevertheless, this does not mean that the Singaporean fish farming firms are unaware of the potential benefits of upgrading and/or are not determined to invest resources in upgrading their operations. To this end, many of them are aware of the benefits of upgrading and some of them have invested substantial resources in their upgrading efforts. Yet, the majority of them are still struggling with their domestic operations and they are also unable to upgrade as quickly and as effectively as what they have planned for. Numi, a supervisor of one of the fish farms, reveals that the state has provided some funding to encourage the firms to upgrade their operations. However, only a small percentage of the firms are able to tap into the fund because there are a lot of prerequisites to conform to, and it is not easy to do so (Interview 13/09/2013). Some of the more commonly highlighted prerequisites are the need to meet a mandated productivity target set by the AVA, the lack of flexibility in adopting certain types of technology and

automation, and the inability to cope with the documentation involved in applying to the AVA (as well as after the fund has been obtained). Rick (the owner of one of the fish farms) reveals that he gave up on the application to the AVA after discovering a mismatch of expectation in terms of financial commitment. Despite the disbursement of some government funding for his proposed project, the financial commitment required to install the necessary new technology was still too large for his firm to undertake (Interview 09/09/2013).

According to the interviewees, two of the most frequently mentioned stumbling blocks to their upgrading efforts centers upon a tacit realization that aquaculture activities is not high on the state's agenda and Singapore's lack of space (on land and on sea). They acknowledge that the agricultural activities of the city-state have been declining steadily ever since Singapore's independence and they do not foresee any reasons for the trend's reversal. One of the most striking remarks is provided by Justin, a fish farmer who has made provisions to sell his farm off and to exit the industry, explains:

It is not that they want to kill us off. It's just that Singapore has its priorities set. The government is more concerned about other pressing matters like jobs and water, especially water. Food production is not too important. Just think of it, if you don't eat fish for a month, no problems. You still can survive. But, if you don't drink water, you can't even last three days. For food, it is much simpler to import rather than grow. Singapore is too small; space is limited (Interview 13/12/2013).

Justin's assertion echoes Lim's (2013) argument that Singapore's food resilience strategy is predominantly centered on international trade, allowing the city-state to source food e.g. food fish competitively, without overtaxing its limited physical resources. Singapore's commitment to a liberalized trade regime – in this paper, it is the wholesalers and retailers downstream of the value chain who take full advantage of this system – also deprives the fish

farming firms of utilizing tariffs and other non-tariff barriers to shield their products from the intense competition of more competitively priced food fish from other places, especially those with a cheaper currency and a lower labor cost.

Furthermore, the land based fish farming firms concede that the space that their farms occupy is worth a considerable amount of money should it be used for developmental purposes e.g. to build public amenities or to sell the space to private developers. For these firms, their existence implies that some “trade-offs” would be involved. They are aware that the state enjoys the final say in terms of land use in the city-state, reinforcing existing studies (see De Koninck, 1973, [1992](#); [Neo, 2007](#)) that underline the state’s control over land use policy, which indirectly curtail the development of space-consuming activities such as aquaculture. This outcome is the direct result of a strong political system, which provides the government with wide powers to acquire and allocate any land it deems necessary for the fulfillment of public projects ([Campbell and Marshall, 2002](#); [Neo, 2007](#)).

For the fish farming firms operating in Singapore’s seaways, the pressure on space is also apparent, but it is not as intense vis-à-vis their land based counterparts. Nevertheless, there is a realization among the sea based fish farms that their farms are occupying precious space within the country’s narrow sea lanes, and that the easy navigation of the sea lanes by merchant ships (a condition made possible if less sea farms are installed) is more valuable than the amount of fish that their farms could potentially raise (Interview 13/09/2013). These firms also cannot expand their production at sea liberally as any establishment of potential fish farms would have to be conducted in consultation with the relevant agencies. Moreover, the sea farms would need to be kept away from the major navigational routes as a precautionary measure against possible collisions with sea vessels because of Singapore’s position as one of the world’s busiest shipping hubs. Reflecting the constraints faced by these fish farming firms, firm F2 conceded that it is also worried that Singapore’s lack of space for

fish farming and the competition of foreign supply of farmed fish would intensify the competition within the value chain. To hedge its risk, it has moved some of its operations to Malaysia. Once the Malaysian farm is fully operational, F2 would raise more exotic fish there in order to capture a higher profit margin (Interview 10/12/2013). Jonathan, a fish farming firm owner who has been in the business for more than 20 years, concurs with F2's decision:

Yes, that's a smart move by F2. As a businessman, you must always diversify your risks... Even if we can grow more fish and increase the variety, we still have to compete against Malaysian, Indonesian or Chinese farmed fish. Their operating cost is much, much lower than ours... (Interview 01/08/2013)

Nonetheless the state has not been wholly unsupportive of the fish farming firms and the broader industry. Section 3.0 outlined the efforts of the state in preserving its agriculture (including fish farming) industry, showcasing the planning, investment, and research and development provisioned for the industry. At sea, it has also established a sea farm off St. John's Island to test the feasibility of deep sea farming using deep net cages as such a farming method would utilize more of the vertical water column than sea area and boost productivity. It is thus clear that the state's intention is to encourage the food fish farming firms (both on land and on sea) to increase their productivity levels, resolving the city-state's inherent space constraint. Nevertheless, such efforts play only a supporting role in Singapore's overall food resilience strategy, complementing the primary thrust of securing food through international trade.

While the GVC and GPN literature has emphasized the notion of upgrading, focusing on the opportunities presented by the global integration of production and trade in specific agricultural commodities within the relevant value chains (e.g. [Gwynne, 2006](#); [Phyne *et al.*, 2006](#); [Saidul Islam, 2008](#)), the findings of this paper do not support such a position. On the

contrary, the overall picture gathered highlights the difficulties involved in sustaining a space-intensive operation (with a comparatively lower value-added content vis-à-vis other economic activities) in a small and space-constrained city-state, notwithstanding the inherent complexities of upgrading per se. Singapore's broader economic success and unique state-society relations – the state's decisive role in matters pertaining to the utilization of land and sea space, and its commitment to a liberalized trade regime to feed its populace – has also led to the realization that aquaculture activities, while vital per se, is not high on the state's agenda. All of these factors collectively discourage the emergence of a sustainable locally embedded aquaculture industry, at least for the foreseeable future.

6.0 Conclusion

This paper has analyzed the Singaporean aquaculture industry, focusing on the fish farming firms operating at the industry's upstream node. It has also argued that the fish farming firms face some stumbling blocks in their economic upgrading efforts. In addition to its inherent space constraint, the city-state's wider institutional context – strict policy in governing the utilization of land and sea space, and commitment to a liberalized trade regime to solve its shortfall in domestic food production – complicates the upgrading efforts of the fish farming firms. Notwithstanding the inherent complexities of economic upgrading per se, such findings prove that while upgrading is an effort driven by the firm and its cohort of stakeholders, the effort is unlikely to bear fruit if the broader institutional and regulatory environment is not conducive.

What then are the policy implications of this paper? One of the most pragmatic things that the fish farming firms could do is establishing a lobby group to collectively negotiate for more support from the state. The establishment of a lobby group representing the interests of the fish farming firms could go a long way in addressing common good issues such as the

increased provision of space for their aquaculture activities. Using the examples of the Norwegian and Irish salmon farming industries respectively, Phyne (2010) demonstrates that collective bargaining organized by the salmon farming firms is a useful means to advance their business goals. However, lobby groups are notoriously difficult to establish as it is inherently challenging to accommodate the interests of the various members as well as to articulate a unified stand on common issues. There is also a lack of leadership among the owners and managers of the fish farming firms surveyed, further inhibiting the possible emergence of a lobby group. If these challenges are not surmounted, it is likely for the dynamics of the value chain to remain constant, complicating the operations and upgrading efforts of the fish farming firms.

References

- AVA (2011). Media Release: AVA Ups Food Supply Resilience Efforts: Helping Local Fish Farms Improve Productivity. Singapore: Agri-Food and Veterinary Authority.
- AVA. (2012). Statistics. Retrieved from <http://www.ava.gov.sg/Publications/Statistics/>
- AVA. (2013a). Agrotechnology Parks. Retrieved 09 October 2013
<http://www.ava.gov.sg/AgricultureFisheriesSector/FarmingInSingapore/AgroTechParks/>
- AVA. (2013b). History. Retrieved 09 October 2013
<http://www.ava.gov.sg/AboutAVA/History/>
- Bair, J. (2005), "Global Capitalism and Commodity Chains: Looking Back, Going Forward", *Competition and Change*, Vol. 9(2), pp. 153-180.
- Bair, J. (2008), "Analysing Economic Organization: Embedded Networks and Global Chains Compared", *Economy and Society*, Vol. 37(3), pp. 339-364.
- Barton, J. and A. Fløysand (2010), "The Political Ecology of Chilean Salmon Aquaculture, 1982–2010: A Trajectory from Economic Development to Global Sustainability", *Global Environmental Change*, Vol. 20(4), pp. 739-752.
- Belton, B. (2012), "Culture, Social Relations and Private Sector Development in the Thai and Vietnamese Fish Hatchery Sectors", *Asia Pacific Viewpoint*, Vol. 53(2), pp. 133-146.
- Belton, B. and S. Bush (2014), "Beyond Net Deficits: New Priorities for an Aquacultural Geography", *The Geographical Journal*, Vol. 180(1), pp. 3-14.
- Belton, B., M. Mafujul Haque and D. Little (2012), "Does Size Matter? Reassessing the Relationship between Aquaculture and Poverty in Bangladesh", *Journal of Development Studies*, Vol. 48(7), pp. 904-922.
- Bush, S. and M. Duijf (2011), "Searching for (Un)sustainability in Pangasius Aquaculture: A Political Economy of Quality in European Retail", *Geoforum*, Vol. 42(2), pp. 185-196.
- Campbell, H. and R. Marshall (2002), "Utilitarianism's Bad Breath? A Re-Evaluation of the Public Interest Justification for Planning", *Planning Theory*, Vol. 1(2), pp. 163-187.

- Challies, E. (2008), "Commodity Chains, Rural Development and the Global Agri-food System", *Geography Compass*, Vol. 2(2), pp. 375–394.
- Chan, K.B. and B.K. Ng (2000), "Myths and Misperceptions of Ethnic Chinese Capitalism", in K. B. Chan (ed.), *Chinese Business Networks: State, Economy and Culture*, Singapore: Prentice Hall & Nordic Institute of Asian Studies, pp. 285-302.
- Chan, K.B. and B.K. Ng (2004), "Singapore", in E. T. Gomez and M. H. H. Hsiao (eds), *Chinese Business in Southeast Asia: Contesting Cultural Explanations, Researching Entrepreneurship*, Surrey: Curzon, pp. 38-61.
- Chou, C.G.H. (1986). *Kelongs in Transition: An Aspect of the Fishing Industry in Singapore*. BSocSci Dissertation. Sociology. National University of Singapore. Singapore.
- Chou, R. and H.B. Lee (1997), "Commercial Marine Fish Farming in Singapore", *Aquaculture Research*, Vol. 28, pp. 767-776.
- Coe, N. (2011), "Geographies of Production II: A Global Production Network A–Z", *Progress in Human Geography*, Vol. 36(3), pp. 389-402.
- Coe, N., M. Hess, H.W.-C. Yeung, P. Dicken and J. Henderson (2004), "'Globalizing' Regional Development: A Global Production Networks Perspective", *Transactions of the Institute of British Geographers*, Vol. 29(4), pp. 468-484.
- Dahles, H. (2008), "Entrepreneurship and the Legacies of a Developmental State: Singapore Enterprises Venturing Across National Borders", *Journal of Developmental Entrepreneurship*, Vol. 13(4), pp. 485-508.
- De Koninck, R. (1973), *Farmers of a City State: The Chinese Smallholders of Singapore*, Quebec: Universite Laval.
- De Koninck, R. (1992), *Singapore: An Atlas of the Revolution of Territory*, Montpellier: Reclus.
- De Marchi, V., E. Di Maria and S. Micelli (2013), "Environmental Strategies, Upgrading and Competitive Advantage in Global Value Chains", *Business Strategy and the Environment*, Vol. 22(1), pp. 62-72.
- Dolan, C. and J. Humphrey (2000), "Governance and Trade in Fresh Vegetables: The Impact of UK Supermarkets on the African Horticulture Industry", *Journal of Development Studies*, Vol. 37(2), pp. 147-176.
- Duval-Diop, D. and J. Grimes (2005), "Tales from Two Deltas: Catfish Fillets, High-Value Foods, and Globalization", *Economic Geography*, Vol. 81(2), pp. 177-200.
- FAO (2012), *The State of World Fisheries and Aquaculture*, Rome: Food and Agriculture Organization of the United Nations.
- Fold, N. (2002), "Lead Firms and Competition in 'Bi-polar' Commodity Chains: Grinders and Branders in the Global Cocoa–chocolate Industry", *Journal of Agrarian Change*, Vol. 2(2), pp. 228-247.
- Gereffi, G. (1994), "The Organization of Buyer-Driven Global Commodity Chains: How U.S. Retailers Shape Overseas Production Networks", in G. Gereffi and M. Korzeniewicz (eds), *Commodity Chains and Global Capitalism*, Westport: Greenwood, pp. 95-122.
- Gereffi, G. (1995), "Global Production Systems and Third World Development", in B. Stallings (ed.), *Global Change, Regional Response: The New International Context of Development*, New York: Cambridge University Press, pp. 100-142.
- Gibbon, P. (2001), "Upgrading Primary Production: A Global Commodity Chain Approach", *World Development*, Vol. 29(2), pp. 345-363.
- Government Publications Bureau (1966). Land Acquisition Act. *Singapore Act 1966, no 41*. Singapore.
- Gwynne, R. (2006), "Governance and the Wine Commodity Chain: Upstream and Downstream Strategies in New Zealand and Chilean Wine Firms", *Asia Pacific Viewpoint*, Vol. 47(3), pp. 381-395.

- Henderson, J., P. Dicken, M. Hess, N. Coe and H.W.-C. Yeung (2002), "Global Production Networks and the Analysis of Economic Development", *Review of International Political Economy*, Vol. 9(3), pp. 436-464.
- Hess, M. and N. Coe (2006), "Making Connections: Global Production Networks, Standards, and Embeddedness in the Mobile-Telecommunications Industry", *Environment and Planning A*, Vol. 38(7), pp. 1205-1227.
- Hill, R.D. (2013), *Agriculture in the Malaysian Region*, Singapore: NUS Press.
- Humphrey, J. and H. Schmitz (2001), "Governance in Global Value Chains", *IDS Bulletin*, Vol. 32(3), pp. 19-29.
- Kagawa, M. and C. Bailey (2006), "Trade Linkages in Shrimp Exports: Japan, Thailand and Vietnam", *Development Policy Review*, Vol. 24(3), pp. 303-319.
- Liew, P.J. (1985). *Agricultural Change in Singapore with Special Reference to Aquaculture*. BA (Hons) Dissertation. Geography. National University of Singapore. Singapore.
- Lim, G. (2013). Singapore's Food Security Strategy. (24 February 2013). Retrieved from <http://asiapacific.anu.edu.au/newmandala/2013/02/07/singapores-food-security-strategy/>
- Lim, G. and H. Neo (2014), "The Economic Geographies of Aquaculture", *Geography Compass*, Vol. 8(9), pp. 665-676.
- Low, L. (1990), "State Entrepreneurship", in T. Y. Lee and L. Low (eds), *Local Entrepreneurship in Singapore: Private and State*, Singapore: Institute of Policy Studies, pp. 150-175.
- Low, L. (2001), "The Singapore Developmental State in the New Economy and Polity", *The Pacific Review*, Vol. 14(3), pp. 411-441.
- Neo, H. (2007), "Challenging the Developmental State: Nature Conservation in Singapore", *Asia Pacific Viewpoint*, Vol. 48(2), pp. 186-199.
- Ngiam, T.T. and L. Cheong (2006), *Singapore*, Laguna: Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA).
- Phyne, J. (2010), "A Comparative Political Economy of Rural Capitalism: Salmon Aquaculture in Norway, Chile and Ireland", *Acta Sociologica*, Vol. 53(2), pp. 160-180.
- Phyne, J., G. Hovgaard and G. Hansen (2006), "Norwegian Salmon Goes to Market: The Case of the Austevoll Seafood Cluster", *Journal of Rural Studies*, Vol. 22(2), pp. 190-204.
- Ponte, S. (2002), "The 'Latte Revolution'? Regulation, Markets and Consumption in the Global Coffee Chain", *World Development*, Vol. 30(7), pp. 1099-1122.
- Rossi, A. (2013), "Does Economic Upgrading Lead to Social Upgrading in Global Production Networks? Evidence from Morocco", *World Development*, Vol. 46, pp. 223-233.
- Saguin, K. (2014), "Biographies of Fish for the City: Urban Metabolism of Laguna Lake Aquaculture", *Geoforum*, Vol. 54, pp. 28-38.
- Saidul Islam, M. (2008), "From Pond to Plate: Towards a Twin-Driven Commodity Chain in Bangladesh Shrimp Aquaculture", *Food Policy*, Vol. 33(3), pp. 209-223.
- Shin, J.-S. (2005), "Substituting and Complementing Models of Economic Development in East Asia", *Global Economic Review: Perspectives on East Asian Economies and Industries*, Vol. 34(1), pp. 99-118.
- Sverrisson, A. (2004), "Local and Global Commodity Chains", in C. Pietrobelli and A. Sverrisson (eds), *Linking Local and Global Economies: The Ties that Bind*, London: Routledge, pp. 17-35.
- Tan, C.-Z. and H.W.-C. Yeung (2000), "The Internationalization of Singaporean Firms into China: Entry Modes and Investment Strategies", in H. W.-C. Yeung and K. Olds (eds), *Globalization of Chinese Business Firms*, New York: St. Martin's Press, pp. 220-243.

- Tey, Y.S., D. Suryani, F.A. Emmy and I. Illisriyani (2009), "Food Consumption and Expenditures in Singapore: Implications to Malaysia's Agricultural Exports", *International Food Research Journal*, Vol. 16, pp. 119-126.
- Vandergeest, P. (2007), "Certification and Communities: Alternatives for Regulating the Environmental and Social Impacts of Shrimp Farming", *World Development*, Vol. 35(7), pp. 1152-1171.
- Wee, C.F. (2014, 24 October). Fish Farms Turn to Home Delivery to Stave Off Malaysian Rivals, *The Straits Times*.
- Wilkinson, J. (2006), "Fish: A Global Value Chain Driven onto the Rocks", *Sociologia Ruralis*, Vol. 46(2), pp. 139-153.
- Yeung, H.W.-C. (2007), "From Followers to Market Leaders: Asian Electronics Firms in the Global Economy", *Asia Pacific Viewpoint*, Vol. 48(1), pp. 1-25.

Table 1: Food Fish Supply in Singapore (2007-2012)

	2007	2008	2009	2010	2011	2012
Domestic Production (Tons; Percentage of Total)	(7,986; 4.8%)	(5,141; 3.3%)	(5,688; 3.7%)	(5,229; 3.4%)	(5,599; 3.8%)	(5,548; 3.7%)
Foreign Supply (Tons; Percentage of Total)	(157,290; 95.2%)	(150,971; 96.7%)	(149,902; 96.3%)	(146,669; 96.6%)	(143,463; 96.2%)	(142,964; 96.3%)
*Total (Tons; Percentage of Total)	(165,276; 100%)	(156,112; 100%)	(155,590; 100%)	(151,898; 100%)	(149,062; 100%)	(148,512; 100%)

*: Export figures are excluded because many of Singapore's food trading firms engage in re-export of food fish products, distorting the overall statistics.

Source: AVA (2012).

Figure 1: Self-Sufficiency Levels of Singapore's Three Key Food Items in 2012

Source: AVA (2012).