

Chapter 2

Development of Food Value Chains in Thailand

Nipon Poapongsakorn, Phunjasit Chokesomritpol, and Kamphol Pantakua

August 2019

This chapter should be cited as

Poapongsakorn, N., P. Chokesomritpol, and K. Pantakua (2019), 'Development of Food Value Chains in Thailand', in Kusano, E. (ed.), *Food Value Chain in ASEAN: Case Studies Focusing on Local Producers*. ERIA Research Project Report FY2018 no.5, Jakarta: ERIA, pp.8–51.

Chapter 2

Development of Food Value Chains in Thailand

Nipon Poapongsakorn, Phunjasit Chokesomritpol, and Kamphol Pantakua

1. Introduction

The development of the food value chain (FVC) is an important part of the agricultural transformation process. With few exceptions, countries that have moved towards the middle-income status have been initially driven along the path of economic growth enabled by the transformation of their agriculture sector. For Thailand, the transformation has resulted in a declining share of agricultural gross domestic product (GDP), specialisation in and diversification towards high-value crops, and dietary changes and supermarket revolution that highly penetrated modern trade. Yet with rising per capita income, the agribusiness – which provides inputs to the farm sector and links it to consumers through handling, processing, logistics, and marketing and distribution – has a large and rising share of GDP across developing countries. Its contribution to GDP growth has been driven by changes in consumer demand and rapid technological and institutional innovation (World Bank, 2007).

Such transformation improved Thailand's competitiveness – from being the 23rd largest agricultural exporter in the 1960s to the 11th to 13th largest exporter in the mid-2010s. This, combined with the developments of several modern value chains, allowed exporters to sell safe food that complies with rigorous international standards requirements, thus acquiring competitive advantage. In fact, Thailand has become one of the world top exporters of rice, sugar, shrimp, chicken, fruits and vegetables, canned tuna and canned pineapple, among others. The competitiveness of these FVCs has been driven by the economies of scale of the agro-enterprises and their capacity to respond to the globalisation of the FVC, thanks to the governments' laissez faire policy. This chapter explains how the modern FVCs in Thailand have evolved, focusing on the pattern and drivers of induced innovation, particularly institutional change.

Though modern FVCs drive the sector's growth, market forces do not guarantee smallholder participation, which is essential to link agricultural growth to inclusive development. Thus, this chapter explores how the modern FVCs provide access of smallholders to the high-value export and domestic markets. A study of FVC development and its determinants has important policy implications.

This research draws heavily from previous studies. To complement the analysis, this research uses secondary data. The study team conducted three focus group interviews with

agribusiness executives and social enterprises, and in-depth interviews with executives in the chicken and vegetable sectors, and leaders of community enterprises engaging in safe vegetable chain. Since there are serious problems of data availability, this study mainly employs the qualitative approach.

2.. Objectives and Research Questions

This chapter aims to (i) briefly explain the theoretical framework of the FVC, its definition, benefits, and emergence; (ii) focus on the FVC development in Thailand, emphasising institutional arrangements, technological change, and drivers; and (iii) analyse two FVC case studies on the vegetable value chain and the importance of farmer groups, and on broiler value chain and how it dealt with external shocks by building resilience.

To guide through the details of each section, a common theme is established to answer the following research questions:

- What explains the induced innovation of the FVCs (i.e. technical and institutional changes)?
- What are the important drivers of the FVCs?
- What factors help link smallholders and farmer groups to the high-value markets?
- What are the barriers?
- What is the performance of traditional and modern FVCs?

3. A Brief Theoretical Framework of the FVCs

To explain the emergence and drivers of the FVCs, one needs to have a working definition on the salient characteristics of modern FVCs, as well as a framework to compare the benefits and costs of the modern FVCs with those of traditional FVCs.

Definitions

Gomez and Ricketts (2013) describe the FVCs as comprising all activities necessary to bring farm products to consumers, including agricultural production, processing, storage, marketing, distribution, and consumption. Value chain analysis considers linkages between participating actors (e.g. farmers, manufacturers, retailers, consumers) and examines the flow of foods from farmers to distributors and to retailers.

However, to understand the emergence and performance of the value chains, one needs to have a theoretical framework. Scholars in commerce are perhaps the pioneers in advancing the analysis of supply chain management (SCM).¹

According to Vorst et al. (2007), 'a supply chain (is) a sequence of (decision-making and execution) processes and (material, information, and money) flows that aim to meet final consumer requirements, that take place within and between different stages along a continuum, from production to final consumption'. The definition emphasises the continuum of processes and three types of flows, which are the critical characteristics that distinguish the modern supply chain management from the traditional supply chain (like the spot markets of rice, cassava, etc.).

Additionally, 'supply chain management is the integrated planning, implementation, coordination and control of all business processes and activities necessary to produce and deliver, as efficiently as possible, products that satisfy market requirements (Vorst et al. 2007).

But the concept of 'value chain' in business management was first described by Michael Porter in his 1985 bestseller, *Competitive Advantage: Creating and Sustaining Superior Performance*. A value chain is a set of activities that a firm operating in a specific industry performs in order to deliver a valuable product or service for the market (Porter, 2008). Value is defined as the amount consumers are willing to pay for what the producers and retailers provide.

In analysing the global production network, T.J. Sturgeon (2001) defines value chain as 'a larger constellation of activities and dynamic configurations embodied in a production network. In addition to this organisation scale, there are other dimensions of value chains, i.e., spatial scale, productive actors and governance style'.

This study uses some of the above characteristics to describe the FVCs in Thailand.

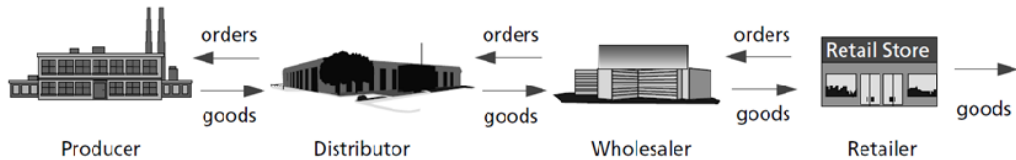
Benefits of the Modern SCM over the Traditional SCM: The Bullwhip Effect in the Beer Distribution Game

The MIT game (Lee et al., 1997) first illustrates the major weakness of traditional SCM. Due to the lack of coordination and timely information on demand changes among chain actors, the traditional supply chain would face huge order fluctuations and oscillations. The producer-received demand would be amplified by 900% from the original retail demand fluctuation, resulting in huge stock-outs at the retail level (Figure 2.1).

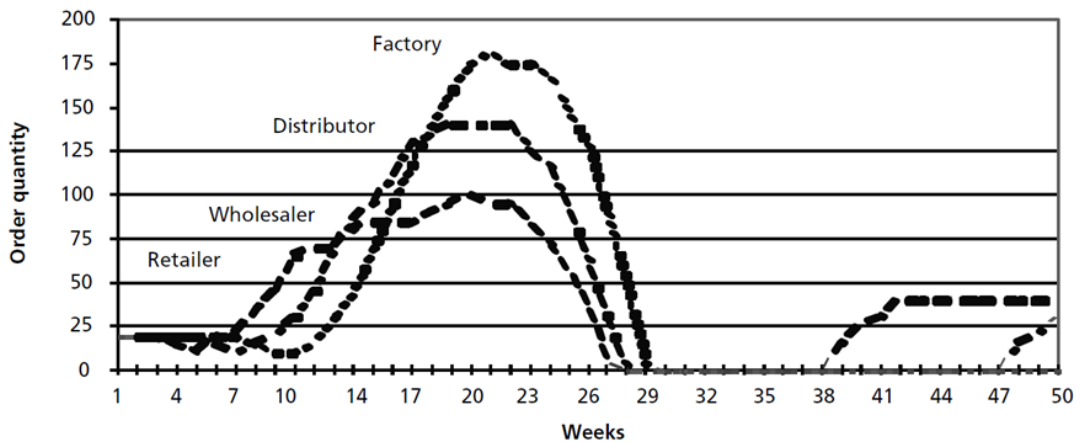
¹ The term 'supply chain management' was first coined by Keith Oliver in 1982, but the concept was introduced in the early 20th century, especially with the creation of the assembly line (Handfield and Nichols, 1999). In fact, the earliest form of supply chain management may have come from military science, which deals with the military logistics.

The modern value chain improves this through organised SCM that relies heavily on ICT. As a result, the modern value chains can minimise inventory cost (also known as 'just-in-time') and reduce order fluctuations.

Figure 2.1. Beer Supply Chain and the Bullwhip Effect



Ordering patterns showing the Forrester or 'bullwhip effect'



Source: Vourst, et al. (2007).

Modern SCM also allows for a larger volume of connection between actors, which enable smallholder farmers into the modern value chain. Timely flow of information also supports appropriate risk sharing according to the risk-management capacity of the actors. As a result, farmers can shift price risk to the contractors or retailers, thus, stabilising market price for consumers. The process improves the chain efficiency and increases the total net revenue of actors in all stages but does not necessarily increase the per-unit profit of a product.

What Explains the Emergence of the FVCs?

New institutional economics uses transaction costs to explain transaction arrangements between various players. In the agricultural value chains, farmers enter into contracts or supermarket procurement systems through networks of suppliers, farmer groups, and non-governmental organisations (NGOs) to supply standardised products.

There are five types of value chain governance: market, modular, relational, captive, and hierarchy (Gereffi et al., 2005). These different types of governance are determined by three factors: (i) complexity of transactions and knowledge transfer, (ii) codifiability and efficient transmission of information and knowledge without transaction-specific investment, and (iii) capabilities of current and potential suppliers.

Governance shift according to these factors is often a reflection of the higher requirements of international trade. For example, the vegetable importers of the United Kingdom (UK) had linked the operation with their relational suppliers in Thailand and Kenya to introduce new items, assure quality control and a year-round stable supply, as well as compliance to food safety regulations and other standards, along with processing of products towards ready-to-eat foods.

The transformation is driven by export and domestic demand from a rising middle-income populace which shifts the dietary pattern (Bennett's Law²) from cheap staple food towards high-value protein, fresh fruits, and vegetables. Modern retailers captured this emerging market by introducing the supermarket revolution.³ Such production means the modern FVCs would require a higher degree of coordination and closer relationship among importers, exporters, and suppliers through regular monitoring and auditing. Their interactions became more complex and relational, which also reduced the number of players involved. Fortunately, the transformation is supported by new technological change especially ICT, digital technology, and biotechnology.

4. Development of the FVC in Thailand

After briefly summarising the characteristics of Thai FVCs, this section describes the major developments of the FVCs and the benefits and costs of linking smallholders to the modern markets and analyses the efficiency of modern and traditional value chains.

The Characteristics of Thai FVCs

The structure of Thai FVCs is dualistic – some are traditional (with spot markets), others are modern chains. The structural classification is based on three criteria: (i) product differentiation, (ii) coordination between buyers and suppliers, and (iii) a shorter chain that links farmers with suppliers or retailers directly.

² Bennett's Law implies income and price elasticity is higher for preferred products (i.e. meat income elasticity is more than bread income elasticity).

³ A term referring to the modernisation of retails that started in the 1940s and continued on to the 1970s in developing countries. The trend began in Southeast Asia in the late 1990s and rapidly matured by the mid-2000s.

The distinction between the traditional supply chain and the modern supply chain, along with the disruptive factors that stimulate the transition, is summarised in Table 2.1. The distinction between modern and traditional value chains is based on seven characteristics: (i) market structure of the products, (ii) marketing channels (or distribution), (iii) technology, (iv) nature of the products, (v) flow of information, (vi) logistics, and (vii) capital and risks. Three disruptive forces are identified: (i) change in consumption pattern, (ii) international trade requirements, and (iii) technology.

Table 2.1 shows that the traditional value chains (spot markets) still dominate a large portion of the agriculture sector – including most commodities such as rice (except organic rice), cassava, shrimp, and most vegetables and fruits (durian, longan, mango), beans, etc. These products are homogeneous but can be classified into different grades and types. Traditional value chains are governed by the highly competitive spot markets dominated by smallholders and small traders at various stages of exchange. Thus, the price risks are mostly borne by farmers. While the information flow in traditional chains is between the two direct trading parties, the information in the modern chains flows directly from the retailers (or exporters) to the farmers. The modern SCM, often linked to the international market or modern retailers, includes most safe fruits and vegetables for the high-end market, such as banana, mango, durian, organic rice, broiler, and dairy products. The trading relationship is long term; thus, the farmers and processors/retailers tend to share risks. But the market structure is oligopolistic, and the products are differentiated. In contrast, the traditional chains are very long chains of fragmented transactions and involving many parties. The logistics is often also performed by small transport companies or agents who have small warehouses, while the logistics in the modern chains is dedicated and carried out by large logistic companies with economies of scale. Unlike the farmer fellows in the traditional chains who have access to credit from agricultural banks or cooperatives, those in the modern chains usually borrow from commercial banks, thanks to their scale of operation and transaction value.

Table 2.1: Comparison between the Traditional and Modern Supply Chains in Thailand

Characteristic	Traditional Supply Chain	Disruptive Factors	Modern Supply Chain
Market structure, organization, and competition	High competition between farmers and middlemen	Consumption	High competition under an oligopolistic setting
	Wholesale and retail spot markets	Increasing income per capita	Vertical integration, or under contracts
	Simple trade, sometimes under credit terms	Concerns over quality and health	Contract farming between farmers and contractors to control both quantity and quality
	Transactions through middlemen	International trade requirements	
		Concerns over carbon footprints and other social problems	
Marketing Channel	Wet market, traditional retails	The rise of supermarkets and modern retails	Modern trade
			Central procurement
			Elimination of middlemen
Production and technology	Chemical intensive	International trade requirements	Sustainable production, organic farming, animal welfare, and environmental protection
	Technology, research, and extensions often provided by governmental officials, input providers, and a few forward-thinking farmers	Trade and investment growth of high-value and safety foods in the export markets	Technology transfer from private companies
		Protectionism policies	technology transfer from private companies
			Modern farm management (GAP, GMP) and traceability system
Products	Inputs bought from local stores or from agents	Technology	Inputs provided by contractors
	Commodity production	Breeding and processing technologies	Produced to match standards and consumers preferences

	Mixed grade, no standards or quality control		Value added through packaging and branding
		Information and communication technologies	Extension services provided by contractors and exporters
			Information transfer from retailers to farmers
		Management and Institutions	
Flow of information	Inputs advertisement	Contract farming	
	Using price as a market signal	GAP, GMP, HACCP, quality control, standards, and traceability system	
Logistics	Middlemen collects products from farmers and transport in bulk to processors or exporters	Central procurement and distribution centre	Dedicated logistics and distribution centre
			Cold chain
Capital and risks	Credit from BAAC/middlemen		Credit from banks
	Trade mostly by cash		Supermarket/exporters get 30-90 days credit term
	Volatile farm-gate price		Advance pricing
	Speculation for profit		Quality for profit
	Retail price adjusts to margin		Retail price adjusts to willingness to pay

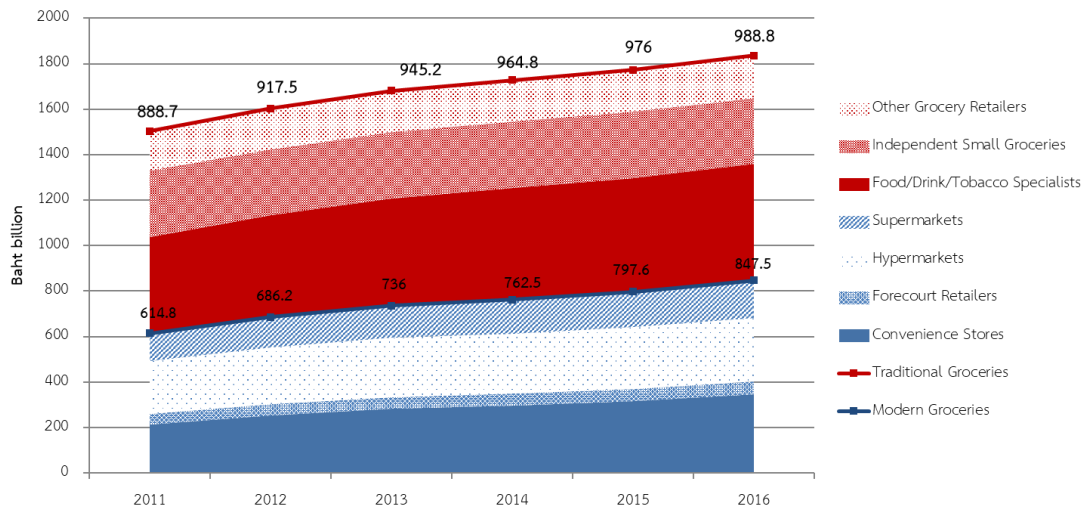
BAAC = Bank for Agriculture and Agricultural Cooperatives, GAP = Good Agricultural Practice, GMP = Good Manufacturing Practice, HACCP = Hazard Analysis and Critical Control Points.
Source: Poapongsakorn et al. (2010).

Four Major Developments of Modern FVCs in Thailand⁴

There are four major developments of modern FVCs in Thailand: (i) the rise of contract farming in the mid-1970s and 1980s, driven by export opportunity; (ii) the rise of the middle class and foreign supermarkets in the mid-1990s, resulting in the re-emergence of farmer groups (Figure 2.2); (iii) the export threats in the late 1990s and early 2000s; and (iv) the new institutions and channels that link smallholders to the market.

⁴ This section draws heavily from Poapongsakorn and Tey (2016).

Figure 2.2: Sales Volume and Share of Traditional and Modern Groceries



Share by Value	2011	2012	2013	2014	2015	2016	Growth (2011–2016)
Modern Groceries	40.9%	42.8%	43.8%	44.1%	45.0%	46.2%	5.98%
Traditional Groceries	59.1%	57.2%	56.2%	55.9%	55.0%	53.8%	2.11%

Source: Compiled by the authors. Data from Euromonitor Passport (accessed January 2017).

- Contract farming as the first means of vertical integration of the FVCs

Perhaps it could be argued that contract farming is the first stage of FVC transformation in Thailand because it was the first time that the agribusiness (contractors) established a vertical link with the farmers using the non-market coordination mechanism.

Contract farming was first introduced to produce chicken and tomato in the mid-1970s. Charoen Pokphand was the first company that introduced the new biotechnology to grow high-yield broiler and recruited smallholders to grow the new variety of chicken through contract farming. The contractual arrangements were a copy of one employed by Arbor Acres Co. with the American chicken growers. The contract was the effective extension means to recruit small growers to grow a modern variety of chicken, which required new farming know-how and new arrangements of risk sharing between the growers and the agribusiness company. While the new technology brought about a better feed conversion ratio, the contract also guaranteed the price and quantity that the company promised to buy, thus providing strong incentive for the growers to join the scheme. As a result, the company has successfully used the non-market vertical coordination to expand its production to satisfy the planned export. In effect, the biological technological change in the late 1970s and 1980s, which can be called the Green Revolution in the poultry industry, is an important driver of such vertical coordination (Schrader, 1986).

The average farm size was 3,000–5,000 birds in the 1980s; it then increased rapidly to 20,000–30,000 birds in the early 2000s, thanks to the introduction of evaporative housing technology⁵ and farmers' access to credit for farm expansion. Now there are a few dozens of both contract farms, independent farms, and corporate farms with 100,000–200,000 birds because of the increasing labour shortage since the late 1990s.

The main driver of chicken contract is the export opportunity to Japan. The company received the promotional privilege for export-oriented production from the Board of Investment. But the most important promotional measure was permitting Charoen Pokphand to establish the slaughterhouse for export. In those days, all operators of animal slaughterhouses had to transfer the ownership rights to the provincial administration. Since the slaughterhouse was owned and operated by the private company, Charoen Pokphand had the incentive to invest in modern slaughterhouse technology, thus exploiting economies of scale and increasing processing efficiency.

At the same time, the government, with assistance from the United States Agency for International Development (USAID), encouraged poor rice farmers in the northeast to grow contract tomato for the American company Adam. The objective is poverty reduction and to prevent the spread of communism. Contract farming was part of the irrigation development project aimed at generating rural employment and boosting the income of poor rice farmers who could grow only one crop of wet season rice. With irrigation, farmers can grow more than one crop per year.

Since then contract farming has been adopted to produce several products, i.e. vegetables (such as asparagus, baby corn, morning glory, etc.); chili; Japonica rice; corn seed; and others. Perhaps the 1990s and 2000s were the golden era of contract farming, thanks to abundant family labour and minimal government regulations on contract farming. The agricultural census showed that the number of contract farms increased from 0.16 million farms in 1993 to 0.26 million farms in 2003, then declined amidst labour shortage.

As discussed below, since the late 1990s, other institutional arrangements have linked the farmers to the market

- The rise of the middle class and foreign supermarkets

In the mid-1990s, after markets in the developed countries were saturated, foreign supermarkets began to invest in Thailand, thanks to rising per capita income (as a result of sustained rapid economic growth since the 1960s) and investment liberalisation. As argued by Reardon and Timmer (2012), Thailand was among the first group of countries that saw the rise of foreign investment by the supermarkets. They are TESCO-Lotus, CARREFOUR, and

⁵ Short for evaporative cooling system housing, this is a type of housing that uses large fans and water to cool down the housing to maintain temperature and moisture suitable for broiler growth.

Ahold Delhaize. These supermarkets introduced the central procurement system which imposes the service level and product standards on their suppliers of fresh products, thanks to an advancement of information technology (Schrader, 1986). The use of ICT started in the 1990s with the progress of computer technology. The early ICT included the use of bar codes and automated warehouse which supermarkets used to reduce inventory costs and quickly respond to consumer demand.⁶ Yet, at the beginning, the supermarkets did not have direct links with smallholders because of extremely high transaction costs of buying from hundreds of smallholders. Instead, they established business links with a few food suppliers who must comply with the service level requirements. Later, some supermarkets began to source directly from the farmer groups, thanks to corporate social responsibility. Gradually, successful business relations enabled some farmer groups to expand the contract production with other farmer groups. For example, one farmer group which successfully produced and supplied banana to convenient stores and supermarkets had been transformed into a company and expanded the contract production with many farmers and farmer groups.

At the same time, some religious groups and NGOs also organised farmer groups to produce organic rice for export (more discussion below).

As a result, the share of modern groceries jumped from 10%-20% in the early 2000s to 46% in 2016 (Figure 2.2).

- Adaptation to the threats against food export

In the late 1990s and early 2000s, a series of threats to Thai export of chicken and shrimp to the United States (US) and European Union (EU) markets led to an institutional transformation in the FVC. Thai export of chicken and shrimp to the US and the EU were found to contain excessive chemical residues, i.e. nitrofurans. The fishing methods of shrimp export to the US were also accused to have killed sea turtles. The outbreak of bird flu in 2004 also led to the loss of chicken meat export as importing countries banned all imports of fresh chicken from Thailand. The export threats forced the private sector and the government to cooperate and introduce new food safety measures and laws as well as to establish a new public organisation, the Bureau of Agricultural Commodity and Food Standards, that would be responsible for the export of safe and standard products. The private companies and farmers that grow chicken and shrimp also rapidly adopted the biosafety and close farming system. Composition of chicken exports also changed significantly from fresh and chilled meat to cooked meat and ready-to-eat products. Thus, the industrial structure became more concentrated as some companies and farms went out of business.

⁶ In the 1970s when Walmart began to expand its branches into the small cities, it used the cross-docking technique to reduce the cost of distributing small lots of merchandises to its stores. Later on the Efficient Consumer Response system was developed by the processed food distribution industry in the United States to recover competitive strength.

- New channels linking small farmers to the high-value markets

In addition to contract farming, three new channels can link smallholders to the high-value markets: (i) re-emergence of farmer groups and new community enterprises, (ii) sustainability certification, and (iii) public-private-producer participation.

Re-emergence of farmer organisations and cooperatives: Since the late 1990s, some high-end supermarkets have begun to procure safe vegetables from a few pioneer farmer organisations, especially those supported by civil society organisations, NGOs, and cooperatives. The collective action of farmer organisations resulted in scale economies in purchasing inputs and selling products, as well as in gaining some market power. It should be noted that most successful farmer organisations in Thailand tend to engage in activities with high profit margin (i.e. providing credit), or in activities with some degree of market imperfection, or perishable products (milk, banana) (Siamwalla et al., 1995).

The success of farmer organisations is attributed mainly to the ability and dedication of the group leaders, which beg a question of sustainability. Since most of these products are perishable, farmers are forced to form an effective organisation to achieve speed and scale economies. Yet their effectiveness can be limited by legal constraints, corruption, and weak governance due to the lack of a prudent regulation framework, as well as the lack of clearly defined property right assignments (Kherallah and Kirsten, 2002; Poapongsakorn and Tey, 2016). Excessive government subsidy also weakens the competitiveness of many farmer organisations.

This means the government should introduce a prudential regulation law and begin work to rationalise the regulations by, for example, (i) allowing cooperatives to function like a business firm in which one dollar is one vote; (ii) encouraging cooperatives to merge to take advantage of scale economies; and (iii) avoiding unnecessary subsidy especially those used in any activities that speculate on the market.

Sustainability certification: Sustainability certification is an impartial, third-party endorsement of the agricultural products of smallholder groups. It enables farmers to tap into niche markets with higher prices and reduces trade barriers. Smallholders must comply with the principles and criteria established by the ratifying organisations. The requirements include Good Agricultural Practice (GAP) and other business management practices encompassing economic, social, labour, and environmental criteria. Examples of sustainability certification, such as Fairtrade, Utz, and Rainforest Alliance, are the key mechanisms that link smallholders to international value chains.

However, the costs of obtaining certifications can be high even if smallholders are already grouped to reduce management costs. This is why some certification organisations, such as the Forest Stewardship Council, have established a smallholder support fund. Yet, there are some problems with sustainability certification. For example, participants in some schemes

are locked into sizeable investment and cannot easily switch to other crops. Moreover, the sustainability certifications reduce reliance on peer pressure as a joint guarantee, as well as the enforcement rights of sponsoring organisations. There are also problems of uneven business relationships between farmers and their buyer/certification organisation.

In effect, food safety and quality problems cannot be handled solely by 'technical means'. Peer pressure is an effective means of reducing violation of contract terms. Trust, therefore, becomes pivotal to the development of high-value modern chains.

Public-private-producer participation (PPPs): Since the domestic markets are rapidly modernising while export markets remain under the purview of many large-scale suppliers, the government and private companies, especially multinational corporations, have reached a consensus on the vital need for an inclusive business model using the PPP approach. PPPs focus on improving the weakest link in the value chains between smallholders and institutional buyers such as supermarkets.

An example is FrieslandCampina which coordinates a dairy development programme to meet the needs of governments, farmer groups, local communities, consumers, as well as the companies' business. Its technical support to dairy farmer groups spans production, processing, to marketing.

Another example is the Pracharat Committee on Agriculture (PCA), a joint public-private programme established in 2016. The movement aims to enhance productivity and reduce the costs for smallholders through multiple PPP projects. Most companies that are members of the PCA are large agribusiness. The PCA is co-chaired by the Minister of Agriculture and a former president of the Thai Chamber of Commerce, but the activities are carried out by the companies with support from government agencies.

However, there is caution against the PPP approach since the PPPs may crowd out public fund for farmers, while some companies may use the programme to influence both public opinion and public policies.

Benefits and Costs of New Institutions Linking Smallholders with the Market: Contract Farming as an Enabler

Eaton and Shepherd (2001) argue that contract farming is the institution that successfully links farmers to the market. One reason is that, until 2018, the Thai government had never excessively intervened in the contract arrangements between agribusiness and farmers, allowing agribusiness firms to introduce different types of contract farming with farmers who grow a variety of crops. In fact, in the 1980s, the government tended to favour the use of contract farming as a means to reduce rural poverty because contract farming allowed farmers to switch from low-value crops such as rice to higher-value products, such as Japonica rice, Basmati rice, exportable vegetables, chicken, etc.

The benefits of contract farming come primarily from continuing contractual relations between contractors and farmers that transfer technologies and knowledge to improve yield and production efficiency. Perhaps the most important incentive for the farmers is the guarantee price which is higher than the market price and guarantee quantity of purchase by the contractor. Another important aspect of contract farming is the risk sharing that buffers farmers from price fluctuations. As a result, the net income of contract growers is higher than that of farmers who grow similar crops but sell in the traditional spot markets (Poapongsakorn et al., 1996). However, Reardon and Timmer (2012) find that the farmers' higher income from participation in the modern value chain is associated with their endowments of non-land assets, particularly education, access to irrigation, product quality differentiation, and quality control, while the effect of their farm holding size is not as clear.

For contractors, contract farming often enlarged their supply base and provides reliable sources of supply for desired quality products that are either not readily available or thinly traded in the open spot market. Moreover, contract farming allows these agribusinesses to ramp up production quickly, stabilise production outputs, and reduce the cost of investment in adjusting to seasonal and irregular changes. Some contractors benefit through internalising technological spillovers by charging higher prices for the quality inputs and extension services or use a tie-in sale of inputs as well as a planned production to match the predetermined orders and market demands. With relatively low risks, contractors can scale up quickly to exploit scale economies in processing and distribution networks, which eventually enable large-scale high-value production for the export markets.

Despite various benefits, some risks are associated with employing contract farming. First, contract farming can be broken by opportunistic behaviours on both sides. Usually when such problem arises, smallholder farmers lack the capacity and resources to invoke a legal process to enforce the contractual undertakings. Secondly, while a contract can reduce the market risk for farmers by shielding them from fluctuating prices, it does not protect them from external risks. In the case of the broiler industry post-bird flu, new public regulations forced growers to invest in new facilities, incurring heavy capital investments. Yet when there are output problems, the contracting firms do not share any output risks. Thus, smallholders may not be able to service their debt.

Contract farming is not a panacea. It can be adopted only for specific types of products which require specific technology, being niche products for the high-end market or subject to government regulations and restrictions. It cannot be applied to commodity products such as rice, cassava, or maize whose transactions are carried out in the competitive spot markets. Also, there are both cases of successful and failed contract farming, which highlight the importance of best practices for the Thai agriculture sector.

Since contract farming is a long-term 'relational contract' that encompasses an adjustment process of a more thoroughly transaction-specific and ongoing administrative kind, it will survive only if it is built on trust. Government regulations should be neither too rigid nor

biased in favour of one side or the other. They should aim at building long-term trust between smallholders (who have weaker bargaining power) and the large-scale agribusiness and include a clause that helps resolve any conflicts should one occur.

Efficiency of Modern and Traditional Value Chains

The benefits of modern fresh vegetable value chain come from improved information flow which enables coordinated activities between actors in the chain. Improved coordination enables the transfer of technologies, knowledge, and good practices from suppliers to smallholder farmers. As a result, the modern FVC is highly efficient and produces higher value added for participants through product differentiation, quality assurance, and made-to-order production that adapt to the changing preferences of consumers.

This is highly relevant to specific niche products such as fresh fruits and vegetables, proteins, and organic produce because there are many aspects to improve and add value. For others produced in mass for the commodity market, value-adding strategy may not be valid for such simple and highly competitive products. Therefore, only some aspects of the modern value chain can be applied to reduce the cost of production.

The adaptation from traditional to modern value chains is, therefore, a transitive spectrum rather than a clear path with common destination. Most transition in Thailand occurred naturally, often led by a few innovative entrepreneurs and industry leaders who foresaw opportunities to take risks and, if successful, make profits. This is why modern value chains in Thailand are highly efficient because cost-benefit analysis has already been included in the decision process by these first movers.

One particular benefit to the farmers and agriculture is the potential for risk and cost sharing between smallholder farmers and suppliers. This is highly important because agriculture is a risky business and market price fluctuation is something most farmers cannot adjust to due to the lack of market knowledge. The modern value chains, with their new organisational structures, provide a degree of buffer and a mechanism at which market knowledge can be realised. As a result, modern value chains can provide a steady source of income for farmers and utilise local employment to create values. Thus, the rise of modern value chains in Thailand is also accompanied by the rise of these new organisational structures (Table 2.2).

Table 2.2: Number of Farmer Groups and Cooperatives by Type (2013–2017)

	2013	2014	2015	2016	2017	Growth, %
Agricultural cooperatives	3,796	3,881	3,822	3,779	3,639	-1.1
Crops	3,628	3,712	3,650	3,613	3,473	-1.1
Fishing	77	79	82	77	77	-0.3
Settlement	91	90	90	89	89	-0.6
Farmer group	4,277	4,296	4,214	4,088	4,930	2.3
Community enterprise	5,100	5,934	7,459	16,174	26,866	43.3
Goods	4,390	4,972	6,383	14,147	23,303	43.8
Service	710	962	1,076	2,027	3,563	39.7

Source: Compiled by the authors. Data from Department of Agricultural Extension (DOAE).

Aside from risk reduction, farmers in the modern chains enjoy higher net income than those who sell to the traditional chains (Reardon and Timmer, 2012; Poapongsakorn et al., 1996).

For the exporters, supermarkets, and modern suppliers, these new organisational structures such as social and community enterprises, farmer groups, and cooperatives provide important services. The aggregation of workforce introduces economies of scale and economies of scope ranging from production, collection, packaging, and logistics. It also saves the cost of monitoring and enforcement of standards and practices to fulfil the contracts.

For agribusinesses, operating within the modern chain allows them to improve their value-adding activities. Poapongsakorn et al. (2010) show that factors affecting the outcome of value-adding activities include (i) shifting consumer preferences, (ii) reliable source of quality raw materials, (iii) chain upgrading, and (iv) business cooperation and integration (Table 2.3).

This econometric model clearly shows that better flow of information and enhanced cooperation would improve the outcome and profit of agribusinesses in the value chain. Cooperation and integration between businesses lead to knowledge and technology transfer which improves production efficiency and increases value added. Furthermore, these enable economies of scale and higher negotiating power. Shifting consumer preferences is another factor that agribusiness must adjust to accordingly and timely to increase product value.

Another important factor is the business practice of business partners within the chain. Good relations and cooperation between producers and suppliers can help secure reliable source of quality raw materials, a crucial prerequisite for high-quality production. Long-term trust would also reduce the cost of monitoring and auditing.

While fluctuating demands can adversely affect business operation and profit and seriously hamper the payback period after heavy investment, digital technologies could play a vital role in providing timely information that the businesses can anticipate and adapt to.

Table 2.3: Factors Affecting the Outcome of Value-adding Activities

	(1)	(2)
Fluctuating demands	-0.324*	-0.364*
	(-1.700)	(-1.710)
New products enter the market	0.057	0.022
	(0.330)	(0.120)
Shifting consumers' preferences	0.416***	0.405**
	(2.710)	(2.450)
Reliable source of quality raw materials	0.537***	0.540***
	(2.860)	(2.780)
Chain upgrading	2.151***	1.992**
	(2.800)	(2.470)
Business cooperation and integration	0.957***	0.787**
	(2.650)	(1.990)
Ability to add value		0.295
		(1.020)
Ability to reduce production losses		0.265
		(0.940)
Ability to communicate information		0.081
		(0.220)
Dummy variable (type of products)	Yes	Yes
N	163	143
Wald Chi2	20.310	21.500
Pseudo R2	0.093	0.110

*p<0.1, **p<0.05, ***p<0.01.

Note: The dependent variable is the impact of an improvement in firm's activities on its value added 3 years after the change, measured by the Likert scale, i.e. 1 = the worst decline in value added, 2 = worsen value added, 3 = no change in value added, 4 = better value added, and 5 = highest increase in value added.

Source: Poapongsakorn et al (2010).

Poapongsakorn et al. (2010) further show that similar factors also affect the outcome of loss reduction activities. These are (i) quality improvement by competitors, (ii) reliable source of quality raw materials, (iii) chain upgrading, and (iv) business cooperation and integration (Table 2.4).

Table 2.4: Factors Affecting the Outcome of Loss Reduction Activities

	(1)	(2)
Fluctuating demands	-0.377** (-2.370)	-0.376** (-2.060)
New competitors enter the market	-0.264* (-1.730)	-0.342** (-1.990)
Quality of products in the market improve significantly	-0.341 (-1.330)	-0.235 (-0.720)
Quality improvement by competitors	0.886*** (2.810)	0.892** (2.210)
Reliable quality of raw materials	0.752*** (3.410)	0.693*** (2.760)
Chain upgrading	2.907*** (2.940)	2.937*** (2.790)
Business cooperation and integration	1.079*** (2.950)	0.991** (2.440)
Ability to add value		0.555* (1.930)
Ability to reduce production losses		0.025 (0.070)
Ability to communicate information		0.184 (0.530)
Dummy variable (type of products)	Yes	Yes
N	144	120
Wald Chi2	30.790	29.750
Pseudo R2	0.161	0.171

*p<0.1, **p<0.05, ***p<0.01.

Note: The dependent variable is the impact of an improvement in firm's activities on its cost 3 years after the change, measured by the Likert scale, i.e. 1 = the highest increase in cost, 2 = higher cost, 3 = no change in cost, 4 = lower cost, and 5 = lowest cost reduction.

Source: Poapongsakorn et al. (2010).

For loss reduction activities, business competition can adversely affect agribusinesses. New competitors entering the market can take away some market share especially if they are more efficient because of new technologies. However, once competitors begin to improve the quality of the products, the entire market would adjust to meet the new market standards. Therefore, those who have invested heavily into specific assets and technologies would find adaptation challenging and must shift their strategies to answer these disruptive forces.

The modern chains seem to have higher production efficiency out of necessity because they have higher requirements and demand high flexibility to fluid markets. However, this does not mean that the traditional commodity chains are not efficient in their own right. Due to

high competition in the market, the traditional commodity chains in Thailand are more efficient than those of neighbouring countries. This is evident by the fact that Thai rice farmers can buy inputs at lower prices and sell outputs at higher prices than farmers in Cambodia, Lao PDR, Myanmar, and Viet Nam, according to a 2016 World Bank rice value chain survey. The depth of fertiliser and seed markets and availability of seeds are also better in Thailand (Table 2.5).

Table 2.5: Input Supply Efficiency of Rice Value Chains in CLMV

Measure	Indicators	Cambodia	Lao PDR	Myanmar	Thailand	Viet Nam
Access to affordable fertilisers	Urea price at farm gate, \$/ton	425	450	460	426	357
	Ratio of price of urea to price of dry paddy	1.8	1.6	2.3	1.1	1.6
Depth of fertiliser market	% of farmers using fertiliser for paddy production	70 (100)	40	90	100	100
	% of farmers using NPK fertiliser for paddy production	80	20	30	90	100
Availability of seeds	Number of new rice varieties released during 2009–2014	3	n/a	19	18	34
	% of demand met by supply of good seeds	10	9	0.4	100	100
Depth of seed market	% of farmers using purchased seeds	20 (80)	10	9	60	53

CLMV = Cambodia, Lao PDR, Myanmar, and Viet Nam.

NPK = nitrogen, phosphorus, and potassium – three common components of fertiliser.

Note: Data in parentheses for Cambodia are for the dry season. All other data are either for the monsoon season or for all seasons on average where seasonal differences are small.

Source: World Bank (2016).

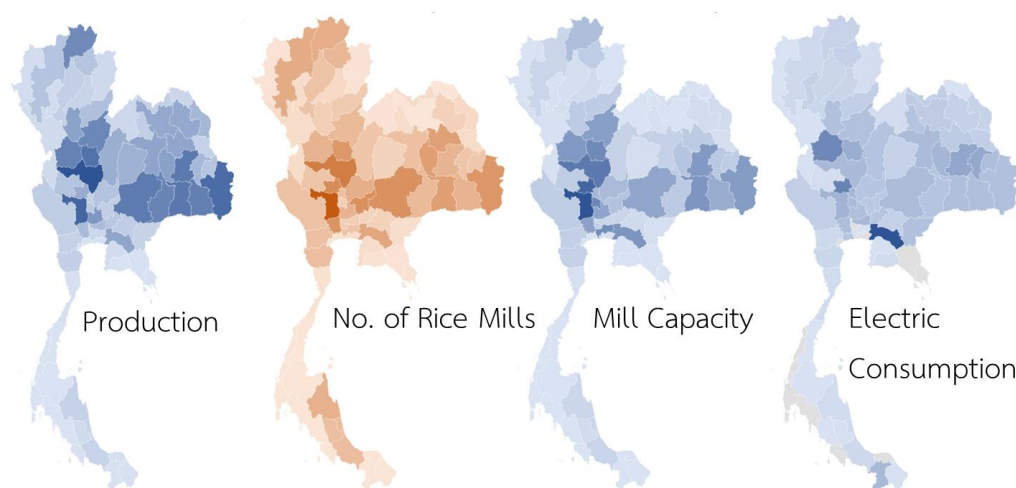
Furthermore, clustering of agricultural production has resulted in the clustering of input suppliers and processing plants in the main production areas. In addition to the impact on competition and efficiency in both the output and input markets as explained above, the clusters also bring about higher value added. The best way to illustrate this is to observe how rice is produced in Thailand.

Rice production in Thailand is clustered at the Central and the Northeastern regions (Figure 2.3), thanks to the delta plains and flat land. Production in the central region relies heavily on

the irrigation networks, allowing the production of dry-season rice around four to five cycles in 2 years. For the Northeastern region, however, the lack of irrigation system means many farmers have to produce low-yield high-quality Hom Mali rice only during the monsoon season.

The heat maps shown in Figure 2.3 clearly show that rice production is clustered only in some parts of the countries. The number of rice mills and their mill capacities seem to reflect the production volume. Chachoengsao, a province in the lower eastern part of the country, has a relatively high electric consumption compared to existing mill capacity. This indicates the high utilisation rate and better resource procurement system, mostly because the province is linked logistically with both sources of production clusters in the central and Northeastern regions. Furthermore, it is also close to the base of consumers in the capital city of Bangkok and to the export ports in the eastern seaboard areas.

Figure 2.3: Thailand Rice Cluster



Source: Compiled by the authors. Data from Office of Agricultural Economics (OAE), Department for International Trade, and Provincial Electricity Authority.

To further investigate this, two regression models (Tables 2.6 and 2.7) are used to calculate the effects of production cluster on the rice value added in each province. The results, as shown, indicate a positive effect of the number of rice traders and millers in the area on the local value added.

**Table 2.6. Effect of Clustering on Provincial Value Added of Rice
(Model 1. Pooled OLS)**

				Number of obs	=	854
				F(3, 850)	=	178.20
Source	Sum of squares	Degree of freedom	Mean squares	P-value > F	=	0.0000
Model	113944595	3	37981531.6	R-squared	=	0.3861
Residual	181167651	850	213138.413	Adjusted R-squared	=	0.3839
Total	295112246	853	345969.808	Root mean square error	=	461.67

raVArice	Coefficient	Standard error	t-statistic	P-value> t	[95% Confidence interval]
lahhw	-239.6496	25.23587	-9.50	0.000	-289.1815 190.1177
latraders	108.7294	14.31538	7.60	0.000	80.63178 136.8271
lamillers	293.4287	20.60203	14.24	0.000	252.9919 333.8655
constant	2996.083	292.7515	10.23	0.000	2421.482 3570.683

Note: raVArice = real value added of rice production in the province
lahhw = natural log of the number of rice farmer households in the province
latraders = natural log of the number of rice traders in the province
lamillers = natural log of the number of rice millers in the province
obs = observations

Source: Calculated by the authors. Data from OAE and Department for International Trade.

**Table 2.7: Effect of Clustering on Provincial Value Added of Rice
(Model 2. Pooled OLS)**

				Number of obs	=	854
				Number of groups	=	58
				Obs per group: Min	=	10
				Average	=	14.7
				Max	=	15
				Wald chi ² (3)	=	157.31
				P-value > chi ²	=	0.0000
				Autocorrelation (u _i , X) = 0 (assumed)		

raVArice	Coefficient	Standard error	Z-statistic	P-value> Z	[95% confidence interval]
lahhw	-400.1579	49.12737	-8.15	0.000	-496.4458 -303.87
latraders	84.99586	11.34136	7.49	0.000	62.76722 107.2245
lamillers	139.0519	31.84827	4.37	0.000	76.63044 201.4734
constant	5293.058	533.7844	9.92	0.000	4246.86 6339.256
sigma _u	390.87574				
sigma _e	263.71584				
rho	0.68719435			(fraction of variance due to u _i)	

Note: raVArice = real value added of rice production in the province
lahhw = natural log of the number of rice farmer households in the province
latraders = natural log of the number of rice traders in the province
lamillers = natural log of the number of rice millers in the province
obs = observations

Source: Calculated by the authors. Data from OAE and Department for International Trade.

5. Value Chain of Fresh Vegetables

This section is a case study on the value chain of fresh vegetables, drawing heavily from the research report prepared for the National Economic and Social Development Board (Poapongsakorn et al., 2017). It focuses on the following research questions:

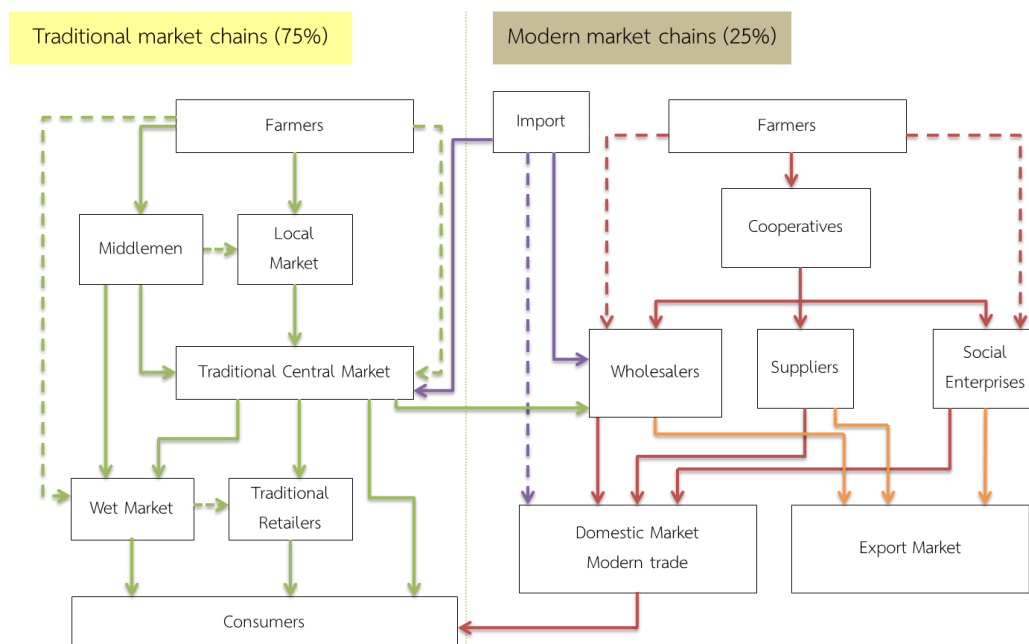
- What are the characteristics of the Thai vegetable value chain?
- Why has the transition from traditional value chain towards modern value chain been gradual?
- What is the strategy to speed up transition and drive growth?
- What are the challenges and policy implications?

The case study partly draws on the author's previous research (Poapongsakorn et al., 2017) which was based on a brain storming with a few vegetable suppliers and traders, a questionnaire survey of 20 vegetable producers, interviews with vegetable farmers, a medium-scale vegetable contractor (who is also an exporter), and three vegetable producer groups (one of which is a community enterprise). The questionnaire surveys and interviews of farmers and farmer groups were carried out in two central plains provinces, Nakorn Pathom and Supanburi, and Nakorn Ratchasima, a northeastern province. The surveys and interviews were taken in 2016 and 2018.

Value Chain Characteristics

Most interesting about the Thai vegetable value chain is its dualistic structure – with approximately 75% of the market share being traditional, and another 25% being modern (Figure 2.4).

Figure 2.4. Dualistic Structure of the Thai Vegetable Value Chain



Source: Poapongsakorn et al. (2017).

The traditional fresh vegetable chain in Thailand still relies heavily on local markets and middlemen as key marketing channels. Most production comes from smallholder farmers who on average have less than 5 *rai* of area (0.8 hectare) and sell their produce in bulk. Farmers grow monocrop or multiple crops depending on seasonal variations and market demands. Examples of monocrop farms are chili and asparagus which are 3-to-5-year crops. Most farmers who grow short-lived vegetables prefer to grow a few crops in one season (if they have large farm holding) or switch from one crop to another.

The smaller scale of production means that the production pattern is often planned and suggested by the middlemen who regularly buy from farmers. Value creation of the middlemen is based on their knowledge and market insights, which facilitate an informal flow of information between actors in the market. These transactions, while are not under contracts, happen regularly, and tend to operate on long-term relationships and trust.

In contrast, the modern chain relies on the formal flow of information and guarantees stable supply through contract farming. The main difference between the traditional and modern chain is highlighted by high-quality products that are supplied to modern retail channels such as supermarkets and exports. The production scale of farmers is similar to those in the traditional chain, but economies of scale are achieved as these individual farmers grouped to undertake other value-adding activities, such as pre-processing, packaging, branding, and marketing.

Of particular interest in the modern chain would be organic and residue-free vegetable products that have lower yield, incur more production cost, and, therefore, are sold at a higher market price. Food safety and traceability, quality assurance, and freshness are the primary attributes that set these products apart to attract higher income consumer.

To achieve these attributes, the modern chains took a more coordinated approach to procurement, utilising contract farming or other organisational structures to manage production and to transfer technologies and knowledge. Agribusinesses as modern suppliers link smallholder farmers to modern supermarkets by setting up a network of farmers and investing in local pre-processing and packaging operations.

The rigorous trade requirement and the need to maintain freshness and shelf life necessitate cold chains throughout the entire logistical process. The logistic chains also employ air transport because production of different vegetables can spread across various locations due to weather, suitable soil, and available labour. Vegetable value chain, both in traditional and modern chains, is highly labour intensive. This defines the practices of the industry, making the transition from traditional chain towards a modern chain very difficult since improved production management means a higher level of attention and care from highly skilled workers is needed.

Transition from Traditional to Modern Value Chain

While modern vegetable chains are increasing, traditional vegetable chains still dominate most of the market. Transitions have been gradual due to various limitations, but most notably due to a relatively higher price of vegetables that consumers are not willing to pay for.

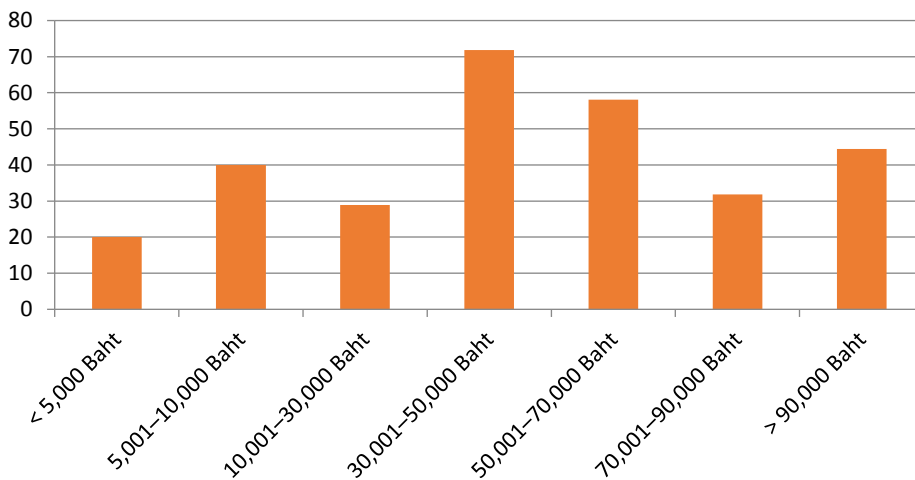
The modern vegetable value chain was first initiated by a religious group called Santi Asoke and a few agribusiness companies that used contract farming to produce temperate vegetables for export to Japan and the EU in the 1990s. Santi Asoke was driven by social, rather than economic, considerations as the group produces and sells safe vegetables to encourage healthy living and a simple way of life. In contrast, vegetable contract farming to Japan and the EU is driven purely by the emerging export markets which can potentially result in more value added.

Since the 1990s, many modern vegetable value chains have been operated by agribusinesses with varying success. The transition towards an entirely modern value chain has been gradual because growth is limited by the domestic market. While more urban consumers are attracted to the convenience that modern retailers bring and the cheaper prices offered as a result of supermarkets' supplier-squeezing tactic, during the early stage of the supermarket revolution in Thailand, Thai consumers still preferred to buy vegetables and fruits from the wet markets, according to a Thailand Development Research Institute study (1999). This is because supermarkets sold vegetables at higher prices and most Thai consumers perceive supermarket vegetables as not as fresh as those sold in wet markets. The production of vegetables in the traditional chain remains significantly cheaper than in the modern one because quality monitoring and assurance by the modern chain add to the cost of production and distribution, while the use of chemicals by smallholders in the traditional chain can reduce labour intensity and costs. On top of this, consumers do not perceive the benefits of higher quality and safer products, and still prefer inspecting the products themselves. A survey of urban samples (Poapongsakorn et al., 2010) shows that 58.5% of consumers had tried products with food safety standards. Among them, about half had tried organic vegetables⁷ while the other half had tried residue-free vegetables.

⁷ There are no official data on production and sale of vegetables. Between 2000 and 2015, production of organic vegetables declined from 3,518.75 million baht (B) to B3,1612.19 million (www.greennet.or.th/article/organic-farming/Thailand).

By the late 2000s, the share of vegetables sold by supermarkets had exceeded that in the traditional chains, thanks to the rise of the middle-income class. Moreover, the demand for safe and organic vegetables has begun to surge rapidly due to the demand from the young generation who is very health conscious and adopts the modern lifestyle. Figure 2.5 shows that willingness of consumers to buy safe vegetables is correlated with their income. This implies that higher per capita income is positively associated with consumers' health consciousness and, hence, higher demand for food safety.

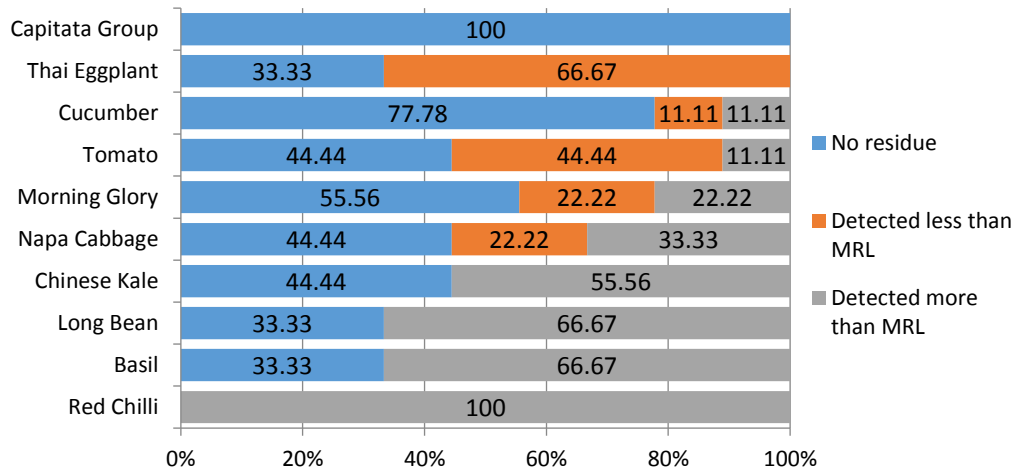
Figure 2.5: Percentage Increase of Those Willing to Buy Safe Vegetables at High prices, by Income Group



Source: Poapongsakorn et al. (2010).

Yet the market for safe and organic vegetables is still highly concentrated in the supermarkets, particularly the high-end ones. This is partly because organic vegetables are still very expensive, and partly because consumers still do not trust these vegetables to be safe. Surveys show that a high incidence of excessive chemical residue is detected in the vegetables sold in all markets (Figure 2.6), including products from farms that are supposed to comply with the safety or organic standards (Figure 2.7). In recent years, most suppliers of high-value and safe vegetables have resorted to use brand names, thanks to the government policy and the initiative of the business associations (more discussion below).

Figure 2.6: Survey of Chemical Residuals of Fresh Vegetables in 2016, by Type^a

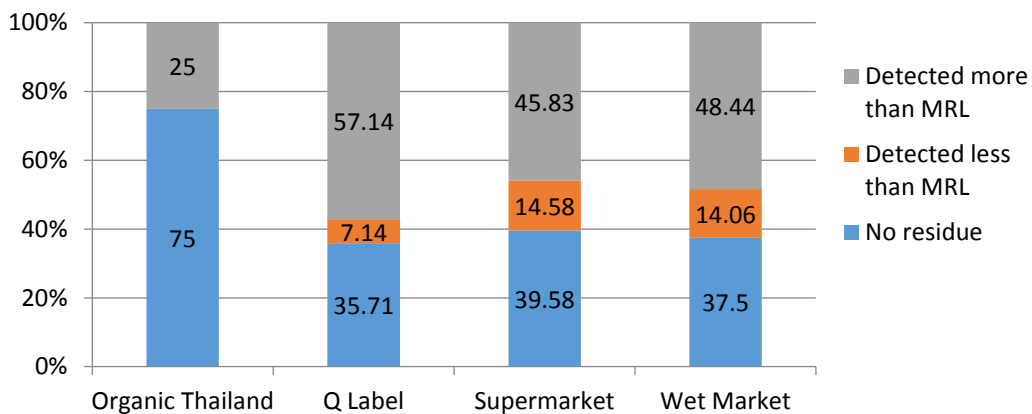


^a Sample size may be too small to give conclusive degree of chemical residuals of vegetables in Thailand; however, it indicates that the problem exists.

Note: MRL = maximum residue limits as indicated by the CODEX ALIMENTARIUS international food standards.

Source: Thai Publica (2016).

Figure 2.7: Survey of Chemical Residuals of Fresh Vegetables in 2016, by Standard and Marketing Channel^a



^a Sample size may be too small to give a conclusive degree of chemical residuals of vegetables in Thailand. However, it indicates that the problem exists.

Note: MRL = maximum residue limit, as indicated by the CODEX ALIMENTARIUS international food standards.

Source: Thai Publica (2016).

This problem persists because whenever there is shortage, some suppliers tend to fill their orders by sourcing from the traditional wholesale markets and re-labelling products with standards to make their products appear safe and of high-quality. They use this quality-shrinking tactic to meet the constant demands of modern retailers. Shortage of safe

vegetables is common because producing these without chemicals is difficult; seasonal variations also plays a role to cause fluctuations in yield.

As urban consumers shifted to modern supermarkets and convenience stores, the role of traditional markets also changed. Most wet markets in Bangkok shifted to wholesale fresh fruits and vegetables in bulk to various restaurants and food stalls. In response to urban consumers' needs for cheap price and convenience, there is also the rise of *Pumpuang* mobile shops⁸ – pick-up trucks retrofitted as mobile markets (Figure 2.8) (The Nation, 2018). These vehicles would source products from the wholesale market and travel to local communities every day, providing convenient access of fresh and cheap vegetables for consumers.

At the same time, convenience stores and express stores⁹ have begun to sell pre-processed and ready-to-eat fresh fruits and vegetables in their many outlets, targeting young office workers who do not have time to go shopping (Figure 2.8).

Figure 2.8: *Pumpuang* Mobile Market and Ready-to-eat Vegetables Sold in Convenience Stores



Source: The Nation (2018).

Strategy to Speed Up Transition and Drive Growth

In addition to the rise of the middle-income class and increased health consciousness among the young generation, the growth of demand for safe vegetables has also been driven by the NGOs, the government, efforts by the business associations, particularly the Thai Chamber of Commerce, the collective action by the agribusiness and the farmers, and the response of restaurants to the increasing demand for organic foods.

⁸ *Pumpuang* pick-ups sell produce at low prices to people in low-income areas. One of its sources of vegetable supplies are the vegetables that cannot be sold at the end of the day and are thrown away by the vegetable suppliers at the wholesale markets because it is not worth carrying them back. The practices help reduce food waste in urban areas.

⁹ Larger than convenience stores but smaller than traditional supermarkets. Often located at high-rise condominiums and communities with access to parking space.

As mentioned, the religious groups pioneered in advocating and providing extension services for farmers to grow organic rice and vegetables. But it was Greennet, an NGO, that seriously launched the projects to commercialise organic vegetables. In 1993, Greennet established its first Cooperative Natural Food Store to sell safe vegetables produced by farmers in the north, central, and south. Then, in 1995, it initiated the capacity building for farmers to produce organic food under the International Federation of Organic Agriculture Movements standards in 1995 and became the first fair trade producer of rice in 2002 (www.greennet.or.th).

After the initial success of the NGO, the Thai government also adopted policies to support the production of organic farms. Among these measures are free advice and free licensing of GAP and organic farm standards. Realising its resource constraints, the Department of Agriculture, responsible for the licensing of GAP, began to privatise licensing services to private firms, which are required to be accredited by the department.

Another strategy to reduce the cost of production is to lower the cost of standards. The Thai Chamber of Commerce developed a cheaper version called the 'Thai Gap'. In 2004, the Chamber of Commerce, in cooperation with the Kasetsart University, launched the Thai GAP standards, which aimed at developing a traceability process for the production of fruits and vegetables using the Euro-Retailer Produce Working Group's GAP. Later, it became known as the ThaiGAP standards, which were developed and adapted from the GLOBAL G.A.P. of the European retail group. The Chamber of Commerce also set up the ThaiGAP Institute to promote the standards, and actively provide ThaiGAP training courses to farmers by collaborating with a local university. The institute also cooperated with supermarket groups and fresh market operators to launch a project of marketing products with ThaiGAP standards and training programmes for farmers.

By 2013, the private sector had begun to support the production and marketing of safe agricultural products. Three associations – the Federation of Thai Industries, the Thai Chamber of Commerce, and the Thai Banking Association – joined forces to introduce the 'Quality Mark (Q-Mark)' label. Q-Mark is not a label of quality assurance but a recognition of the social responsibility of small and medium-sized enterprises – both producers and suppliers.

On the production side, the main strategy to speed up transition and drive growth of the modern chain is to reduce the cost of production and ensure high-quality products through good farming practices. As mentioned, production of safe vegetables can fluctuate a lot due to seasonal variations and the limited use of chemicals. The solution by the agribusiness firms to this problem requires collective efforts and coordinated production management by the farmer groups.

Improving production management requires a planting schedule that considers factors in seasonality and weather irregulars. To do this, farmers in the same area must combine into farmer groups, community enterprises, or cooperatives to (i) share labour and knowledge; (ii)

reduce risk from market price fluctuations; (iii) achieve scale economies which reduce operating costs, increase their bargaining power when buying inputs or when selling products, and reduce the cost of biosecurity between farms; (iv) allow them to apply for income tax exemption; and (v) serve as a means of building consumers' trust through local branding and marketing.

Contract farming is also an essential part in securing a stable supply for modern suppliers, while providing reliable income for the farmers' group. Often the production management plan and good practices are transferred from agribusinesses to farmers under contracts. Contracting community enterprises are allowed to sell vegetables to other wholesalers or suppliers as long as they supply the required order to the contractor first. This extra production volume provides stable sourcing capacity for the contractors and additional income for contracted farmers. Therefore, contract farming provides a formal flow of information and risk sharing between value chain actors.

Aside from this, some agribusinesses have invested in a packing house and pre-processing area for the farmers' group. This value chain upgrading for local farmers extends from mere collection to grading, packaging, pre-processing, and logistics and is highly suitable because it generates year-round employment and increases values for rural communities. Farmers can undertake these activities after their primary farm duties in the early morning. These value-adding activities also benefit the agribusinesses. By moving the packing stations and pre-processing areas close to the local area of production, the suppliers can maintain freshness, improve lead time, and extend shelf life.

Grouping also encourages good practices between farmers as they start to cross-check each other since their reputation relies on collective efforts. Penalties are imposed on those who do not comply to standards or good practices. Grouping also lowers the cost of monitoring and enforcing standards and contracts and reduces the cost of getting safety standard certification and setting a traceability system. This is particularly important because the cost of getting international standards such as the 'Global Gap' or the private supermarket standards can be too high for smallholders.

Aside from grouping, a new rising trend among young farmers is to be independent. Equipped with precision technologies, many young farmers grow high-value crops, such as melon and tomato, and other high-value vegetables. They use modern digital technology, especially precision agriculture, and social media as a marketing channel. They form an alliance with other young farmers or university professors to share technological information.

On the consumption side, chemical residue and contamination remain to be the top problems that undermine consumers' perception of safe vegetables. Promotion of safe food production and health campaign is a basic strategy to drive domestic demand growth. Recently, there has been a new wave of growth driven by the young generation. Two reasons are (i) Bennett's Law where the higher income consumers are more willing to pay for the

higher prices of fruits and vegetables, and (ii) a rise in health consciousness among urban consumers as shown by the increase in sports activities and fitness trend. Many young consumers are now willing to pay higher prices for good health.

A strategy to induce domestic demand growth can come from restaurant use. A particular example is Ohkajhu, a popular restaurant chain in Chiang Mai and Bangkok that serves dishes with organic vegetables using the 'from farm to table' concept (Figure 2.9). This restaurant chain has been very popular among young urban consumers.

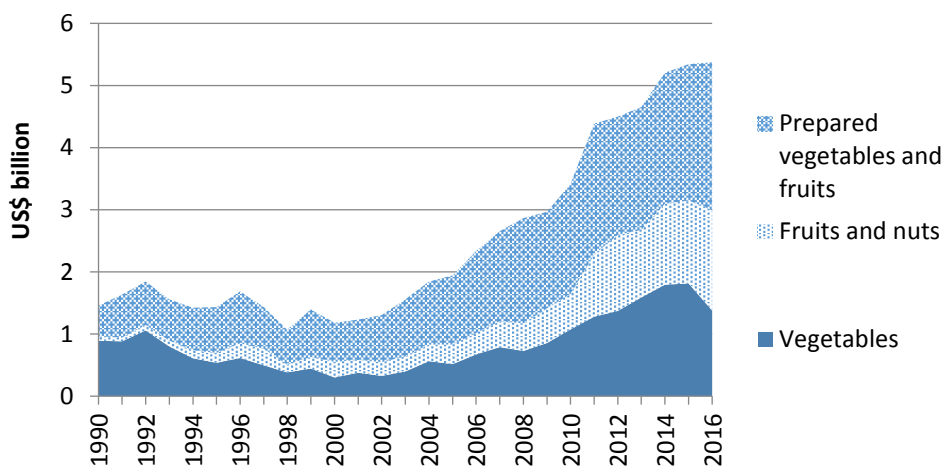
Figure 2.9: Ohkajhu Restaurant Chain



Source: www.ohkajhuorganic.com

For Thailand, the export of fresh vegetables and fruits has enjoyed steady growth (Figure 2.10). While the annual growth of fresh vegetable export in 1990–2016 is at 3.51%, the annual growth of fruits export is much faster at 11.54%. Currently, the largest market is China, followed by Japan, ASEAN, and the EU (see Annex).

Figure 2.10: Thailand Export Value of Fresh Fruits and Vegetables (1990–2016)



Growth Rate (1990–2016)		%
Vegetables		3.51
Fruits and nuts		11.54
Prepared		5.91

Source: Compiled by the authors. Data from United Nations Comtrade (<https://comtrade.un.org/>).

The main obstacle to export growth is rigorous trade requirements. For example, agribusinesses that want to supply high-quality fresh vegetables to supermarkets in the UK require (i) farm standards such as the Global Gap certification, Tesco Nurture, and Leaf Marque; (ii) production standards such as the Good Manufacturing Practice, Hazard Analysis and Critical Control Points, and British Retail Consortium; and (iii) management standard such as the Ethical Trading Initiative. These standard certifications span from food safety to social and environmental concerns.

All processes in the value chain require a traceability system and documentation that allow consumers and retailers to trace products back to the farm of origin. With the help of modern digital technologies, the traceability system is online, accessible via QR code and embedded with spatial location of the farm.

The supermarkets in the UK see fresh produce as strategic – the product line that could persuade consumers to shift from competitors to them. To facilitate procurement, UK supermarkets prefer a few suppliers that can deliver on time and in bulk. Therefore, a ‘single basket’ strategy is used by ‘KCFresh’, a Thai agribusiness that began to source some vegetables from Zimbabwe and Ethiopia and combined these with those from Thailand to create a single basket for the supermarkets. This strategy takes advantage of the global value chain by optimising the supply mix from places with high comparative advantages. In this particular case, KCFresh chose Africa due to lower costs of production, lesser problems on insects and pests, and quicker and more efficient local institutions. Similar contract farming is used to link local farmers.

Challenges and Policy Implications

Most Thai small exporters still export to the low-end markets in Europe and China because the requirements are not as strict as those demanded by high-end markets in the EU and the UK. The government needs to provide incentives for small exporters to upgrade their operations so that higher value added can be realised.

Producing organic fresh vegetables without chemicals can be difficult particularly in tropical countries where pests are the big issue. Coupled with seasonal variations, the yields fluctuate and supply becomes volatile, thus, resulting in cheating by farmers and wholesalers. The lack of trust among domestic consumers is the biggest concern that needs to be addressed to increase domestic consumption. However, public investment in domestic food safety is too small relative to export by large companies. To fix this, close cooperation between the government, private sector, civil society organisations, and NGOs is required. The most challenging issue is to devise the appropriate food safety rules (institution) and incentives that are acceptable to all concerned stakeholders. Unless the rules are enforceable at reasonably low costs, the prices to the consumers would be too high.

Another important challenge is labour shortage as Thailand already has an ageing society and most young people do not wish to work on farms. To solve this problem, community enterprises or cooperatives can be established to share labour costs. Alternatively, modern technologies, particularly precision farming, can be used to increase the level of automation.

The key takeaway from the dualistic nature of the Thai vegetable value chain concentrates around the issue of value. Strategy in value chain development always focuses on increasing the value added through upgrading with new activities, or value creation through product differentiation and quality assurance. However, value chain development must follow the markets, particularly on the purchasing power and preferences of consumers. It is important to add value, but it is useless to add value if the products cannot sell.

6. Broiler Value Chain

The research questions in this section are as follows:

- What are the characteristics of the Thai broiler value chain?
- How did the industry adapt to external shocks and build resilience capacities?
- What are the strategies to secure high-value markets and to integrate local and regional markets?
- What are the challenges and policy implications?

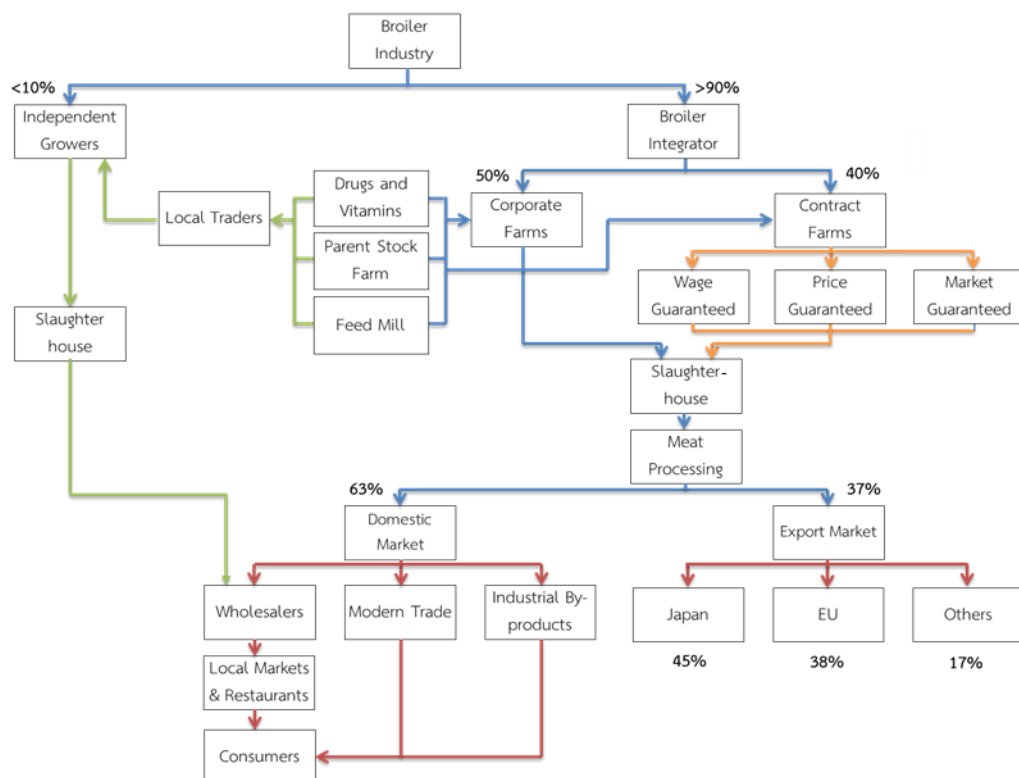
The information for this case study is from a study by Poapongsakorn et al. (2017). The data used in that study was from the focus group workshops with the broiler industry and the

association of corn traders. A survey questionnaire among 40 broiler growers and interviews with corn suppliers in two eastern provinces, Chonburi and Chachoengsao, were carried out in 2016.

Value Chain Characteristics

The Thai broiler value chain is vertically integrated by integrators who dominate the market share by more than 90% (Figure 2.11).

Figure 2.11: Vertical Structure of the Thai Broiler Value Chain



EU = European Union.

Source: Adapted from Poapongsakorn et al. (2017).

The Thai broiler value chain is considered a 'star' among the Thai livestock sector, being the first to transition from backyard farming towards a fully industrialised production. Large-scale production and scale economies were captured and led to highly successful exports to Japan and the EU. While different cuts of some high-value parts were exported, other parts of the chicken were dumped in the domestic market, effectively making chicken meat the most affordable protein source for Thai consumers.

To ensure high-quality production and stable output, the broiler industry has been vertically integrated since its inception. The 'integrators' had established a foothold in the industry by

securing strong links to inputs (feeds mills, breeders, drugs) and to outputs (slaughterhouses, processing plants, and modern retailers). The early success of the broiler industry can be attributed to four enabling conditions:

The first condition is contract farming, which serve as a buffer that reduces growers' loss. For integrators, contract farming provides a mechanism that allows them to scale up production rapidly yet shielding them from the risks of investing heavily. Furthermore, contracts allow the integrators to adjust the volume of production flexibly to seasonal and irregular changes. For farmers, contract farming provides them with substantially higher yield at guaranteed price, risk sharing, knowledge transfer, and access to high-value international market.

Under contract farming, new technologies were transferred from Arbor Acres in 1970 and were adopted quickly. The introduction of poultry genetics and the 'CP707' commercial breed enabled a high-yield, low-death-rate chicken suitable for intensive farming. On top of this, the industry used ready-mixed feed to improve growth and raise the feed conversion ratio to save production cost. The rate at which farmers adopted new technologies was extraordinary as a result of contract purchase requirements.

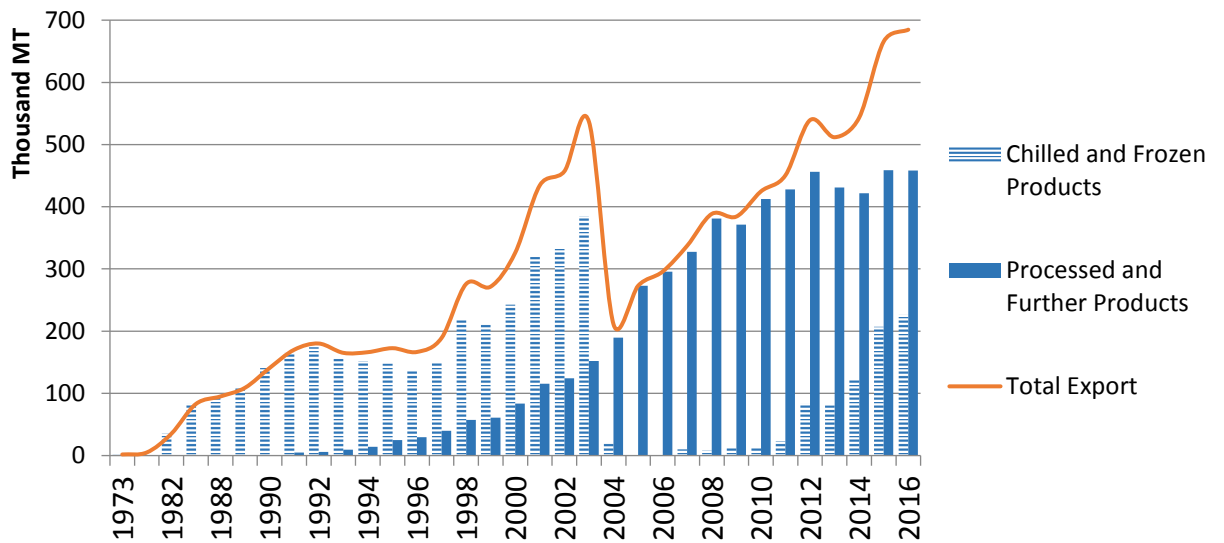
Another important factor in the initial stage of broiler value chain development was cheap labour and abundance of feeds that provide the industry with huge comparative advantages in the region. The short distance between Thailand and high-income countries, such as Japan, has resulted in cheap logistical and transport costs that competitors in the US and Brazil do not have.

Lastly, investment promotion was one important factor that positively encouraged the transition of broiler value chain, allowing Charoen Pokphand to establish the modern slaughterhouse for export without having to transfer the ownership rights to the local government, as stipulated in the law at that time. The Thai government's laissez-faire attitude towards regulation gave freedom that encourages the private sector to self-regulate and adopt its own standards to compete in the international market. New investment promotion privileges were aimed at large-scale production and, thus, were applicable to companies with more than B50 million of working capital. This ensured scale economies and an oligopoly structure of the industry.

Building Resilience

The broiler industry has always been adaptive to changes, quick to adopt new technologies and continually seeking new markets. During the development of the modern value chain, the Thai broiler industry has encountered technological and competitive shifts, a shortage of raw materials (particularly maize), an economic shock, avian influenza outbreaks, and environmental concerns. This section describes the series of shocks that adversely affected the industry and investigates how they were overcome.

Figure 2.12: Broiler Industry Export Growth and Shocks



Source: Chokesomritpol, et al. (2018).

Figure 2.12 shows industry export growth since 1973 when the modern value chain started. Between 2004 to 2006, a series of bird flu outbreaks hit the industry, resulting in export bans of chilled and frozen chicken from various trade partners. However, the industry was protected by the export of processed and further products¹⁰ which did not face the same treatment. From then on, many agribusinesses shifted their operations from exporting frozen chicken to processed and further products.

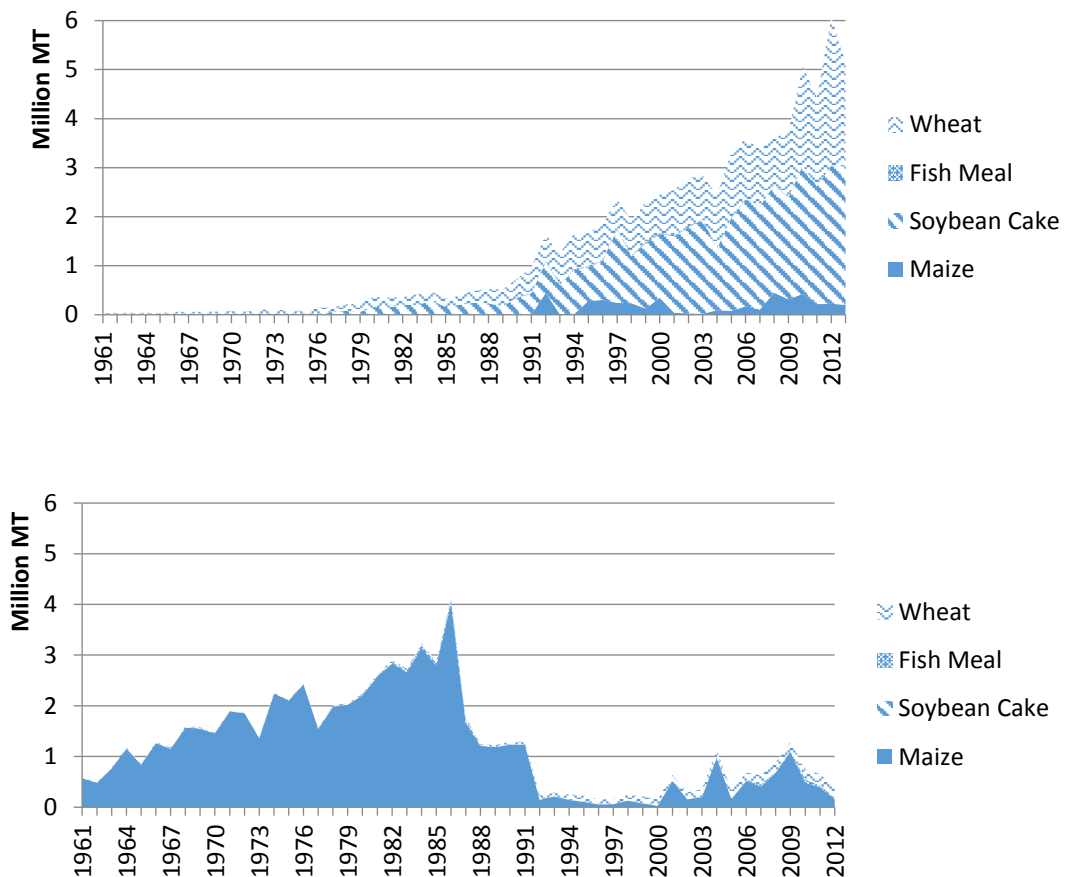
The processing capability and know-how did not come in a day. Continuous efforts to counter various shocks and changes were exerted, which aim to both increase value and improve resilience. Before the bird flu outbreaks, several events already determined the outcome for the post-bird flu restructuring.

The first event was the lack of feed supply. In the late 1980s, the scale of broiler production and other livestock sub-sector had become so large that it exceeded feed production capacity. In response, the industry began to import feeds (Figure 2.13), thanks to the gradual phase-out of the trade-related investment measures to comply with the agreement of the World Trade Organization and the free trade agreements with countries that export maize, such as Australia. Moreover, some Thai companies have introduced contract farming with farmers in Myanmar and the Lao PDR to grow maize, thanks to the Ayeyawady-Chao Phraya-Mekong Economic Cooperation Strategy scheme. Yet the government's price support policy for maize had increased the costs of imported feed, which hampered competitiveness of the Thai broiler industry.

¹⁰ Short for further processing of products (i.e. cooking and seasoning).

To reverse the situation, some agribusinesses introduced new value-adding activities by using the then-cheap labour to pre-process and cut certain high-value parts of chicken (such as breasts). The new line of products attracted the high-income Japanese consumers, allowing the industry to compete in the international market.

Figure 2.13: Thailand's Feed Imports (top) and Exports (bottoms) (1961-2013)



Source: Chokesomritpol et al. (2018).

The second event is the rising wage in the 1990s. The industrial boom began to attract many workers from the agriculture sector, resulting in a decline in the size of agricultural labour force and rapid increase in real wage rate in the early 1990s. Thailand's competitive advantage began to disappear while other Asian competitors with cheaper labour costs such as China began to catch up on exports with an added advantage from closer proximity to Japan.

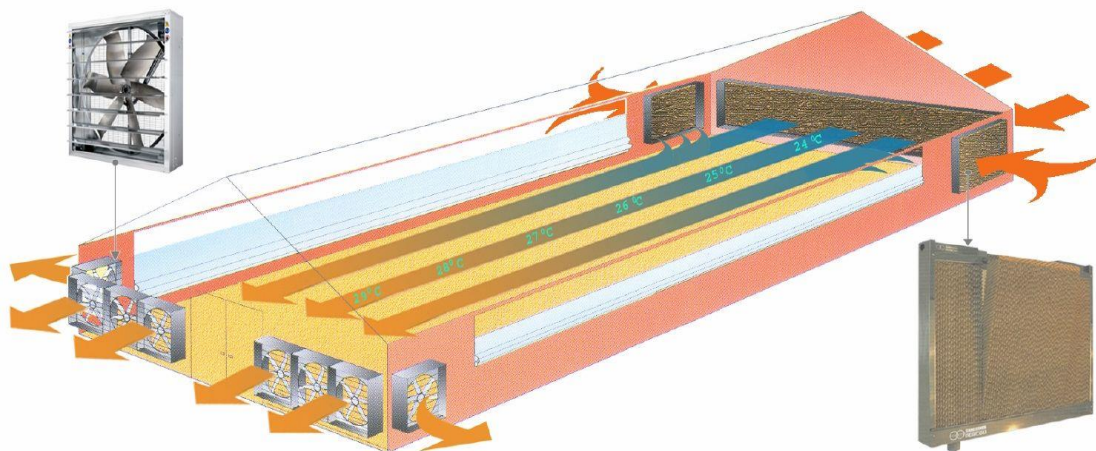
Around this time, the Thai industry began to shift to higher-value processed broiler products, shifting from frozen boneless chicken to processed and pre-cooked chicken in the form of ready-to-eat and ready-to-reheat products. These new lines of products had become an important export that had grown steadily since 1991. By 2000, the exports of processed

chicken were at 69,329 tons, amounting to 22.5% of the total export quantity and 36% of the total export value of chicken.

The third event is the introduction of the evaporative cooling system in poultry houses and automated feeding system. Thailand is not really suitable for intensive broiler farming because high temperature and humidity stress the broilers, which affect the growth and resistance to disease of chickens. The import and modification of EVAP housing from the US helped concentrate as many as 5,000 to 10,000 birds in a single house and increase the scale of production. The EVAP system in Thailand uses large fans and water to cool down the housing to around 28°C. These lower temperatures significantly reduce stress, resulting in increased growth and lower mortality rates. Thanks to the labour shortage and increasing labour cost, large family farms and company farms have been automated through the adoption of automated feeding systems, for example.

The closed system also provides disease control, removes bugs, and allows more chickens to be raised per square meter. Unlike the EVAP systems in the US, Thai EVAP houses do not use full automation but use more labour to host more chickens most likely because labour cost in Thailand is much lower.

Figure 2.14: Evaporative Cooling System Housing



Source: www.parakaset.com (see in Khunrak 2017).

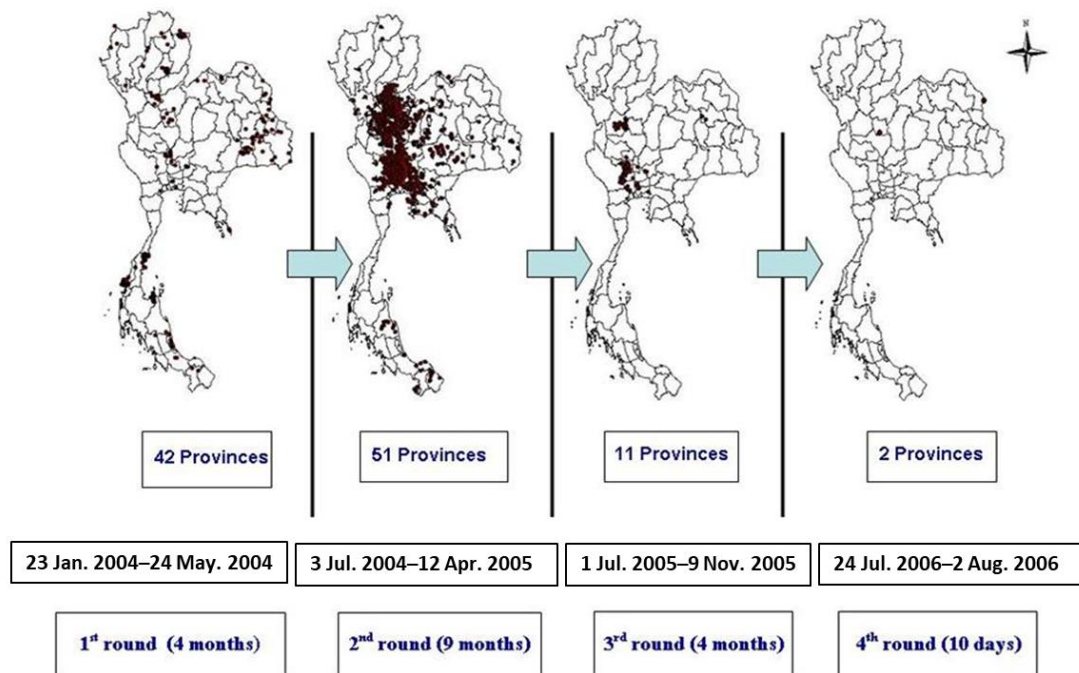
The fourth event is the increasing trade requirements in the early 2000s. Driven by food safety and animal welfare of the EU markets, many Thai exporters initially view these measures as protectionism. But in 2002, nitrofurans and dioxin were detected in broilers exported to the EU, causing a massive shift in practice among agribusinesses and regulations by the Department of Livestock Development. At the same time, the market for antibiotic-free broilers in Japan was emerging. As a result, the Department of Livestock Development imposed a new farm standard to comply with these issues, effectively turning many farms to EVAP housing. Many integrators began to shift from sourcing chicken via contract farming to

an in-house production to increase control over all input uses. This is to ensure a 'from-farm-to-table' traceability scheme.

As a result of these shocks, the industry continuously adapted and modified its standards while bringing a larger share of production processes in-house. By doing so, integrators would have better control on all inputs used. The shifting of some of the production lines of companies towards pre-cooked and processed products was seen as a value-adding activity to overcome higher production costs. This approach was later recognised as the way out during the serious bird flu shocks.

The Avian influenza (known informally as bird flu) outbreaks between 2004 to 2006 (Figure 2.15) forced a swift and decisive response from the government. Strict regulations were issued to stomp out all affected animals while AI vaccination was banned. While the approach incurred significant losses, the industry was able to contain further spread of the disease; consumers also gained better trust of the Thai chicken. New farm standards have been issued so that all farms will be upgraded to closed evaporative systems. Quarantine and movement control were applied nationwide, together with an intensive surveillance program known as 'X-ray'.

Figure 2.15: Bird Flu Outbreaks in Thailand



Source: Santiwattanatam (2005).

Post-avian flu restructuring following destructive shocks saw a huge transition from contract farming towards in-house production. Many integrators downgraded themselves by combining the lowest value-adding activities such as chicken raising as part of the compartmentalisation strategy which monitored the entire production processes. Multiple compartmentalised production zones were constructed distantly separate from each other for biosecurity. This is to ensure that when one compartment is compromised, others can still maintain integrity and export with the trade partners.

Even after the outbreak was gone, the export of chilled or frozen chicken to high-value market did not pick up. These products, along with other low-value parts, were diverted to lower-value domestic and regional markets in ASEAN.

The outbreak of highly pathogenic avian influenza (HPAI) also initiated a transformation of poultry processing. At the time of the ban, frozen/fresh products accounted for about two-thirds of exports by weight. Following the HPAI outbreaks, in just 3 years, the volume of exported pre-cooked and processed chicken almost doubled while fresh products made up less than 1% of the total. In some sense, the structural shift towards pre-cooked products had been under way for some time to comply with some importers' food safety and animal welfare requirements in the mid- to late-1990s. However, the HPAI outbreaks were the call to action for many industry leaders to accelerate the transition in order to survive.

As a consequence, the broiler industry has substantially transformed and became more concentrated at all levels.¹¹ The average farm size has increased to more than 20,000 birds per house. Many broiler farms are now growing more than 100,000 birds at a time, thanks to the adoption of the closed farm system. Since the industry is characterised by the vertical integrated structure, a few integrated companies now dominate fresh and cooked chicken in the domestic and export markets. Only two major brands of chicken products are now sold in the supermarkets in Bangkok. Smaller firms with small processing plants can serve the small markets in the rural areas. Yet the number of chicken processing plants for export had increased from 25 factories in 2004 to 27 in 2018, while the total number of processing plants sharply increased from 400 to 1,089 factories in the same period,¹² according to the Department of Livestock Development. Although there are still about a dozen export firms, the number has declined from the pre-bird flu era.

¹¹ No official information on market share and number of commercial farms in Thailand is available, resulting in the difficulty of analysing the industrial structure, conduct, and performance. In 2015, Prachachart Business Online reported that the production share of the seven largest chicken integrators in chicken processing was 80%. Since then, the second-largest firm has gone bankrupt, and the third-largest company has aggressively and rapidly expanded its business.

¹² The increase is partly because most, if not all, processing plants must register with the Department of Livestock Development.

Strategies to Secure High-value Markets and Market Integration

The Thai broiler industry was so successful and highly resilient because the industry was able to maintain its existing markets by adapting quickly to new trade requirements and changing consumer preferences – in particular, their social, environmental, and animal welfare concerns. Not only has it been able to maintain export competitiveness, the industry's strategic successes come from the continuing efforts to seek new emerging markets. By doing so, these companies have been moving for greater profits, while diversifying their risks.

To cope with the shocks, these companies adopted new technologies quickly and maintained a tight control of information flowing within their companies. A business-to-business strategy is used to link foreign trading firms with a high-quality made-to-order product. Following trade disruptions, the government unit also employed government-to-government negotiations to mend the broken links between the Thai companies and the trade partners.

The expansion of Thai production has been accompanied by investment in foreign, often emerging, markets where there are trade risks from either competition or protectionism. In recent years, the industry is moving into ASEAN countries to capture domestic markets, but investment is still at an early stage. The approach to investment varies differently according to local contexts, such as market preferences and local demands for meat, infrastructure readiness, local resource availability, and government policies and regulations.

The Charoen Pokphand Group, for example, is using the Sri Racha model of the mid-1970s in the developing countries of ASEAN, investing in feed businesses, and employing local contract farmers to scale up production gradually at the same pace as local demands. In ASEAN, the company's expansions were also facilitated by local financial institutions and were often granted privileges through direct negotiations with the local governments. In contrast, the investment decisions into the more developed economies, such as the US and Turkey, had been in the direction of rapid growth through mergers and acquisitions.

Challenges and Policy Implications

FVC development is not only about 'developing'; it is also 'sustaining'. Thus, it is equally important to improve resilience capacities. The role of government (in this case, the Department of Livestock Development) is very vital to the industry's success especially when facing unexpected shocks. While production is moving away from contract farming towards in-house production, this implication may be industry-specific only to livestock sub-sectors.

Despite all the successes, the industry faces four major challenges. The first, and perhaps the most important, is the haze in a few northern provinces and neighbouring countries where contract farmers grow maize on untitled forestlands. Some agribusiness companies now adopt a policy not to buy maize from those areas. But it will seriously affect poor farmers' income because maize is probably the most convenient crop for them. Although burning corn

cobs is not the only cause of haze, the problem is extremely difficult to solve since most farmers there are very poor.

The second challenge is the price support for maize which affects the production cost. The government is now promoting the growing of maize as the second crop after rice so that farmers will earn a higher net income than from the dry-season rice. But the current trade war between the US and China may result in lower world maize price, which will benefit the animal feed producers and chicken processors but will affect the farmers' income unless the government will subsidise the farmers.

The third challenge is the unexpected shocks, such as bird flu, which will seriously affect the farmers and the agribusiness companies. The main concern is how the contractors will help share such risks with the farmers. Without such risk-sharing arrangements, many farmers may face heavy debt and go bankrupt in the next major bird flu outbreak. In addition, the government and the industry must constantly monitor the bird flu situation and establish an effective warning and preventive system.

The last challenge is the fierce challenge from the Brazilian broiler industry, which is more competitive than that of Thailand, thanks to the abundant feed supply and economies of scale from very large farm holdings and processing. In the past, the Brazilian industry did not have much interest in the Asian markets because it has large markets in Europe and Middle East. Since the Chinese market has been growing rapidly, Brazil is now penetrating this market. In addition, it will not only compete in the market of fresh chicken but also in the further products market, which is Thailand's competitive edge. One Brazilian company is investing in Thailand probably to get accustomed to, acquire more experience in, and enter the market for further products in Asia, particularly China and Japan. To compete successfully, the Thai broiler industry will have to adopt a new competitive strategy, such as investment in research and development.

7. Conclusion

This paper uses the theoretical framework of the FVC to explain the development and characteristics of modern FVCs in Thailand, emphasising institutional arrangements, technological change, and key drivers. Two FVC case studies – vegetables and broiler value chains – are described. The paper describes major developments of modern FVCs: the first one initiated by contract farming in the mid-1970s, and the second, by the supermarkets in the mid-1990s. The main drivers are access to export markets, rising per capita income, technological change, and increasing health consciousness among the young generation (particularly the demand for safe vegetables). Though the broiler industry and production of safe and organic vegetables are now governed by the modern value chains, most FVCs are dualistic in nature. Our previous study shows that operating in the modern FVCs allows the participants to improve their value-adding activities and reduce loss in the value chains.

Factors affecting the outcome of value-adding activities include (i) shifting consumer preferences, (ii) reliable source of quality raw materials, (iii) chain upgrading, (iv) business cooperation and integration, (v) better flow of information and collaboration between stakeholders, and (vi) fluctuating demand. Yet the traditional FVCs are highly efficient, resulting in high farm-gate prices of products and low input prices bought by the farmers. Smallholders' benefits from the access to the high-value markets are the return to specific non-land assets, particularly knowledge and capital investment.

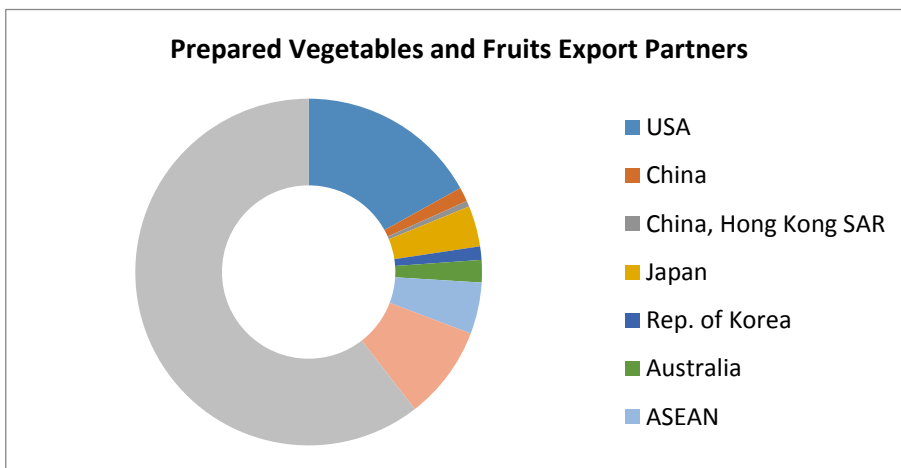
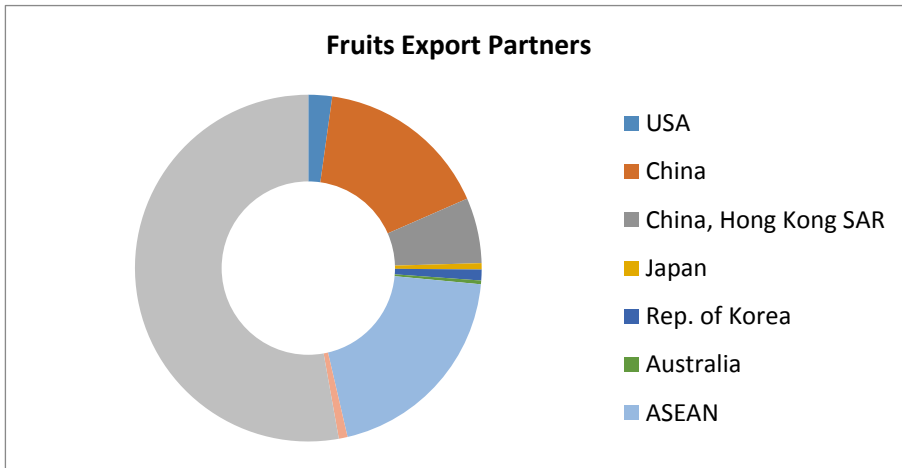
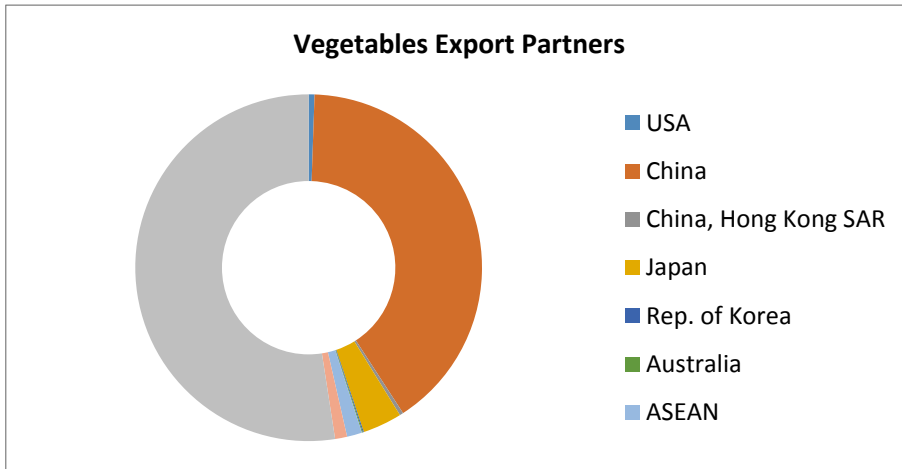
The paper also identifies key challenges, namely, the feed cost, haze problems, and external shocks in the broiler value chains, and food safety as well as labour shortage in the vegetable chains and provides some policy recommendations.

References

- Chokesomritpol, P., V. NaRanong, and A. Kennedy (2018), 'Transformation of the Thai broiler industry', *IFPRI Discussion Paper* No. 1765.
- Eaton, C., and A.W. Shepherd (2001), 'Contract Farming: Partnerships for Growth', *FAO Agricultural Services Bulletin* 145. Rome: FAO.
- Gereffi, G. and K. Fernandez-Stark (2016), 'Global value chain analysis: a primer', *Duke Center on Globalization, Governance & Competitiveness*.
- Gereffi, G., J. Humphrey, and T. Sturgeon (2005), 'The governance of global value chains', *Review of international political economy*, 12(1), pp.78–104.
- Gómez, M.I. and K.D. Ricketts (2013), 'Food value chain transformations in developing countries: Selected hypotheses on nutritional implications', *Food Policy*, 42, pp.139–50.
- Handfield, R.B. and E.L. Nichols (1999), *Introduction to Supply Chain Management*. New York, NY: Prentice-Hall, p.2.
- Kherallah, M. and J. Kirsten (2002), 'The New Institutional Economics: Applications for Agricultural Policy Research in Developing Countries', *Agrekon* 41(2), pp.110–33.
- Khunrak, P. (2017), Effect of evaporative cooling system on egg performance in laying hen, In seminar class of Department of Animal Science, Faculty of Natural Resources, Prince of Songkla University.
- Lee, H.L., V. Padmanabhan, and S. Whang (1997), 'The bullwhip effect in supply chains', *Sloan Management Review*, 38, pp.93–102.
- Poapongsakorn et al. (2017), Impact of ASEAN Economic Community on Thai Agriculture Competitiveness, A research report prepared for the Office of the National Economic and Social Development Board. Bangkok: TDRI [in Thai].
- Poapongsakorn, N. and Y.S. Tey (2016), 'Institutions, Governance, and Transformation in Southeast Asian Agriculture', In C.F. Habito, D. Capistrano, and G.C. Saguiguit Jr. (eds.), *Farms, Food and Futures: Toward Inclusive and Sustainable Agricultural and Rural Development in Southeast Asia*. Los Baños, Laguna, Philippines: SEARCA.

- Poapongsakorn, N. et al. (2010), Supply Chain and Logistics Management of Agricultural Products, A research report prepared for the National Economic and Social Development Board. Bangkok: TDRI. [In Thai]
- Poapongsakorn, N., A. Siamwalla, S. Praneetvatanakul, P. Charroenpiew, S. Tulyawasinpong, and M. Ruhs (1996), Contract Farming and Feasibility of BT Cotton Contract in Thailand. Prepared for Monsanto Corporation. Bangkok: Thailand Development Research Institute (TDRI).
- Porter, M. (2008), *Competitive Advantage: Creating and Sustaining Superior Performance*. New York, NY: Simon and Schuster.
- Porter, M. (1985), *Competitive Advantage: Creating and Sustaining Superior Performance*. New York, NY: Simon and Schuster. (Originally published).
- Reardon, T. and P. Timmer (2012), 'The Economics of the Food System Revolution', *Annual Review of Resource Economics* 4(1), pp.225-64.
- Schrader, L.F. (1986), 'Responses to forces shaping agricultural marketing: Contracting,' *American Journal of Agricultural Economics*, 68(5), pp.1161-66.
- Santiwattanatham, B. (2005), CPF Compartmentalization (Broiler Integration), Presentation, The FAO-APHCA/OIE Regional Avian Influenza Economic Assessment Workshop, 26-29 September, Bali, Indonesia.
- Siamwalla, A., N. Poapongsakorn, and P. Charoenpew (1995), The Economic Farmer Organizations: Success and Survival, A paper prepared for the TDRI 1995 Year-end Conference, December 1995, Pattaya, Thailand.
- Sturgeon, T.J. (2001), 'How Do We Define Value Chains and Production Networks?,' *IDS Bulletin*, 32(3), pp.9-18.
- Thailand Development Research Institute (TDRI) (1999), Impact of the Big Foreign Supermarkets on the Thai Retail Markets. A research report prepared for the National Research Council. Bangkok: TDRI.
- Thai Publica (2016), 'Thai-PAN เปิดผลตรวจผัก-ผลไม้ ซีพีตรา Q แซมพ์สารเคมีตกค้างมากที่สุด – ผักตบชวาเกินค่ามาตรฐานซ้ำซากติดต่อกัน 3 ปี,' www.thaipublica.org/2016/05/thai-pan-4-5-2559/ (accessed 18 September 2016).
- The Nation (2018), 'Mini Big C trucks prompt concern from mom-and-pop vendors and "Pumpuang" trucks', www.nationmultimedia.com (accessed 16 September 2016).
- Vorst, J.G.A.J. van der, C.A. Da Silva, and J.H. Trienekens (2007), *Agro-industrial Supply Chain Management: Concepts and Applications*. Rome: FAO.
- World Bank (2016), 'Leveraging the rice value chain for poverty reduction in Cambodia, Lao PDR, and Myanmar,' *Economic and Sector Work Report*, 105285-EAP.
- World Bank (2007), *World Development Report 2008 – Agriculture for Development*. Washington, DC: The World Bank.

Annex: Major Export Destinations of Thai Vegetables and Fruits, 2016



Source: Compiled by the authors. Data from United Nations Comtrade (<https://comtrade.un.org/>).