Chapter 3

The Development of Industrial Agglomeration and Innovation in Thailand

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Abstract

This study aimed to look at agglomeration development in Thailand. The textile and garments industry, and the electrical and electronics industry were used as the examples to explain the development. Interviews were also conducted with representatives from both industries that were used for the case study. Mail survey was used to gather data for three groups of firms, local companies, foreign companies and joint venture companies. The focus of the survey aims to identify influential factors to agglomeration and the innovation of the agglomeration. Based on the result of the survey, some of the factors were found significantly affecting to the development of Thai industrial agglomeration. However, the innovation of agglomeration cannot be concluded clearly since the result from the analysis showed that there were no significant common factors to explain the upgrading of industry among models.

INTRODUCTION

Strong economic background usually comes from strong industrial section of the country that is why most of the countries try to strengthen their industries. However, the strength of industry in each country may come from different paths. For industrial countries, they have originally built their own technology and industrial system. Until the present time as the world becomes smaller, many companies from industrial

countries seek for the new opportunity to invest outside the country. Non-industrial countries such as many countries in Asia are their targets of investment. Many of non-industrial countries have then turned up to be the new industrial countries; Thailand is one of them. Now, gross domestic product (GDP) of Thailand is depended on industrial section rather than on agriculture section as it used to be in the past. As the new comer in industry, Thailand has to find the right way to promote industry of the country in the long term. Industrial agglomeration is one of the effective ways to strengthen the industrial section of Thailand. Therefore, to understand the formation of industrial agglomeration is quite essential for the country to allocate the limited resources to promote industrial agglomeration. Not only helping in suitable resources allocating for the country but also by understanding the formation of industrial agglomeration, it can help the country to understand the needs of them. By the concept Flowchart Approach, Kuchiki, A. and M. Tsuji (2008), the formation of industrial agglomeration can be understood stage by stage. However, the detail of each stage is depended on each country environment (Kuchiki, A., and M. Tsuji, 2005).

   History of Thailand's industry can be dated back not more than 50 years ago. From the agricultural country in the past, today Thailand becomes one of the leading industrial countries in South East Asia. Even the short history but the country has been changed a lot and it is very interesting to understand this change. Foreign direct investment (FDI) has played the essential role for the development of Thai industry. With FDI at the earlier time, now some industrial agglomerations have been slowly formed. The agglomeration of industry can strengthen the industry of the country. Therefore, the study of agglomeration development is the objective in this study. The focus of this study aims to identify influential factors to agglomeration and the innovation of the agglomeration by analyzing the data obtained from the survey. Twenty factors were investigated in the survey and the innovation of agglomeration was identified by checking if there was any upgrading in term of technology of production, product, market and sources of supply in the past three years.

   This report starts with a discussion of the Thai government policy on industrial clustering to provide some context for the succeeding sections. The next section gives a summary of the development of the two industries in Thailand. The data for the survey were summarized as descriptive statistics and analyzed by econometric analysis in the

last two sections.

1. RESEARCH OBJECTIVES AND METODOLOGY

This study was conducted to analyze the current situation of industrial agglomeration in Thailand in all aspects, including influential factors to agglomeration and innovation of agglomeration. Specifically, it focused on two major sectors, the textile and garments and the electrical and electronics industries.

The research consisted of two parts: a mail survey conducted in November 2007 to collect primary data for statistical analysis and econometric analysis, and interviews with the companies used as the case study.

Since the two groups of industries mentioned have played very important roles in the industrial agglomeration of Thailand, some companies from those groups were selected to represent their respective industries for the cases study: Toshiba Thailand Co. Ltd. for the electrical and electronics industry, and Thai Rut Knitting Co. Ltd. and Oriental Garment Co. Ltd. for the textile and garment industry.

2. THE GOVERNMENT POLICY ON INDUSTRIAL CLUSTERING IN THAILAND

In the past, Thailand development policies were usually a top-down process. The top authorities provided policy and direction, then lower level government agencies would follow. However, the development of industrial clusters would require a very different technique.

According to the flowchart approach (Kuchiki and Tsuji 2008), the development of industrial clusters can be subtle and complex. It requires a synchronization of many components, from both public and private sectors. Therefore, instead of using a presumption and generate a top-down policy, the Thai government attempted to determine the right combination of top-down and bottom-up approaches for which the

policy will not be presumption- issued without a thorough study about the relationships among the business groups involved. Until the formation of relationships that evolved into a network in a well-defined geographic area can be clearly identified, then the government policies and supports could not be issued. Some examples of the relevant government policies discussed below.

In 2004, the government of Thailand planned to support the development of eight industrial clusters. The plan was to have two clusters in each of the fours regions, namely, the North, the Northeast, the Central and the South. It was reported that these industrial clusters would be developed upon 33 existing core industries such as foods, garments, automobiles, electronics parts, plastics, electric appliances, household products, and the like. The Central region where many industrial estates were located, was hoped to become an economic hub of Southeast Asia.

Also, in December 2003, the Board of Investment of Thailand (BOI) released a new investment policy, stating that the provincial clusters should be developed from the viewpoint of improving industrial competitiveness. This provincial industrial cluster strategy of the BOI was designed to support the provincial development plan of Chief Executive Officer (CEO)- Governors. The BOI strategy planned to set up 19 clusters in 4 regions of Thailand as follows:

1. The North (16 provinces, 3 clusters) is to be the IT cities and software parks through of foreign direct investments (FDIs) from the United States (US), Japan and India.

2. The Northeast (19 provinces, 5 clusters) is to be the One Tambon One Product (OTOP) related research and development (R&D) hub and supporting industries related with investment from Japan and the US.

3. The Central and Eastern regions are to be the biotechnology, agro-related R&D, automobiles, electronics, tourism and distribution- related industries through investments from Japan, South Korea, US, and the European Union (EU).

4. The South (14 provinces, 5 clusters) is to be a cluster of tourism, distribution, rubber, and *halal* food for Moslems, considering its closeness to Malaysia and Singapore.

The Industrial Estate Authority of Thailand (IEAT) also planned for the development in specific industrial clusters following the national policy. According to the National Industrial Estate Strategic Plan of the IEAT, the plan for the development of two other industrial clusters is as follows: automobile industries in the Eastern Seaboard which is also known as the "Detroit in Asia", and fashion industries in the Gemopolis industrial estate and textile-garment related industries in Ratchaburi and Kanchanaburi provinces.

In the fiscal year 2005, under the National Science and Technology Development Agency (NSTDA) policy to push forward and increase the potential of the country's science and technology, the National Metal and Materials Technology Center (MTEC) adjusted its operational strategy towards a program-based and integrative operation among the existing national centers under NSTDA, so as to be in line with the development of the major clusters, namely:

1. food and agro-industry,
2. medical and public health industry,
3. automotive and transportation industry,
4. software, microchips and electronics industry,
5. energy and environmental industry, and
6. textile and chemical industry.

3. TEXTILE AND GARMENT INDUSTRY AND ELECTRICAL AND ELECTRONICS INDUSTRY

The textile and garment industry and electrical and electronics industry have a long history of development and have played very important roles in industrial agglomeration in Thailand. This section provides a brief review on these two groups of industries.

3.1. History of Development of the Textile and Garment Industry in Thailand

The history of the Thai textile and garment industry dates back to as early as the

Sukhothai period in the 13th century where cotton and silk products were handmade family products. It has slowly developed until 1922 to 1925 when Chinese merchants brought the Chinese loom into Thailand. The Thai textile and garment industry since then started to grow rapidly and can be classified into seven periods: 1) setting up of textile factories (1950-1959), 2) producing instead of importing (1960-1971), 3) producing for export (1972-1981), 4) industrial expansion for export (1982-1991), 5) gradual declining (1992-1996), 6) economic crisis (1997-2001), and 7) preparation for free trade (2002-2006). Along with these periods, some of the companies have developed themselves into large companies such as the Oriental Garment Co., Ltd. but some companies remained small such as Thai Rut Knitting Co., Ltd.

The textile and garment industry has long been a major player in the development of Thailand's economy. For example, in 2004, export from this sector was as high as 6.4 billion US dollars. Every year, it generates more than a million jobs for skilled workers in the fibers production process from yarning, knitting, dyeing, printing and finishing.

From the interview with the owner, it was found that Thai Rut Knitting Co., Ltd. was currently in a very risky status that relies on a very few customers and few suppliers. The company maintains tight relationships with the suppliers who can discuss more than business issues. There is no contract made for orders or any down payment paid for them. For example, if some orders were cancelled, the materials would remain in the stock. Moreover, each order is tied to the US currency, which has been fluctuating a lot lately, necessitating for orders to be renegotiated for the lower price. The owner once considered moving the factory to another province but was afraid of the local government power that might affect the business.

The Oriental Garment Co., Ltd. is a larger and much more advanced company. Its buyers put pressure to them to lower the lead-time for the whole supply chain. The cluster between tier one and tier two suppliers has been formed and organized by the buyers as the Supplier Summit. Moreover, the buyer organizes the Supplier Summit to create the relationship among the suppliers' group.

The buyer can select the whole chain of suppliers through this summit, which encourages all of the suppliers to work together toward a common goal of improving their production time and quality. Those suppliers who can improve the lead-time and quality of their products will remain in the cluster. However, due to the tax

infrastructure and the check price system, it has been noted that the domestic materials and supply products tend to have much higher cost than the imported ones. This encourages the use of imported products instead.

In October 2005, the BOI had commissioned a group of researchers through the Thailand Textile Institute to conduct the study *"Development and linkage between entrepreneurs of textile and garment cluster for investment development"* in four target provinces, namely, Bangkok and Metropolis, Samutsakorn, Nakornpathom, and Ratchaburi. These four sites were chosen because most of the textile and garment companies in Thailand are located in these provinces. The main objective of this study was to inform both government and private sectors with the current situation of the industry so they could prepare for the forthcoming challenges. The study focused on the following five aspects:

1. Components and distribution
2. Structure of production and trade linkage and logistics
3. Demand and supply estimation
4. Competitiveness
5. Business environmental improvement

3.2 History of Development of Electrical and Electronics Industry in Thailand

After successfully installing the electric lamps in the hall of the palace and lighting them up on the birthday of King Rama V on 20th September 1884, the Thai electrical and electronics industry has been developed gradually. The golden age of electrical industry in Thailand can be claimed to have started in 1955. It was the year that the first Thai-owned electronic-parts producer company was first established, "Thanin Company."

In 1959, the government made the policy to stimulate the development of the electrical industry infrastructure. From then on, the development of Thai electrical and electronic industry has been growing rapidly and can be classified into the following five periods: 1) production instead of importation (1960-1971), 2) production for export (1972-1985), 3) industrial expansion (1986-1992), 4) promotion of support industries (1993-1997), and 5) renovation of industrial infrastructure (1998-present).

From the interview with the Toshiba group, we found that the key factors that encouraged the foreign company to invest in Thailand were the labor cost and the business loyalty. The Thai Toshiba group has started setting up a small research and development (R&D) unit to develop new product designs for the domestic market. The factors that help these domestic companies to upgrade their business are again the costs of labor and energy.

The Thai Toshiba group maintains the same suppliers due to factors of reliability, quality, and good relationships where the former factor is given a higher priority. Another key factor for this industry is the energy cost. From the interview however, it was found that the tax infrastructure discourages the clustering in Thailand because it makes the cost of raw materials and locally supplied products higher than the imported ones.

Both the electrical and electronics industry, and the textile and garment industry still require a lot of skill workers and engineers. Thus, one of the key factors for inducing the growth in these two industries is the human resource preparation. The electrical and electronics industry is starting to develop its R&D, which requires engineers with advanced skills; on the other hand, the textile and garment industry requires skilled labor. Thus, a more aggressive government policy to stimulate the growth in these industries is required.

4. DESCRIPTIVE STATISTICS FROM THE SURVEY

The mail survey was conducted in November 2007 by sending questionnaires to 1,800 companies by mail, by e-mail and some of the questionnaires were distributed in person by random. The response rate was 8.8%, with 160 valid responses returned and most of them came from management people..

This section of the analysis will separate the respondent-companies into three categories: 1) 100% local, 2) 100% foreign, and 3) joint venture. Comparison across the three categories will be carried out on different factors to analyze their differences in perspectives and future plans.

4.1. Age of the Companies
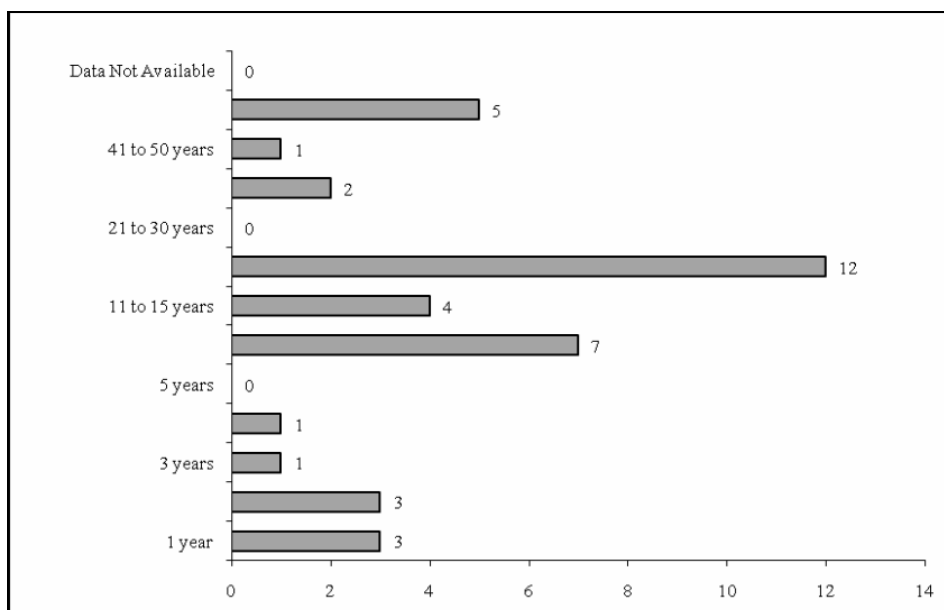
The following figures show the number of years the companies have been established in Bangkok.
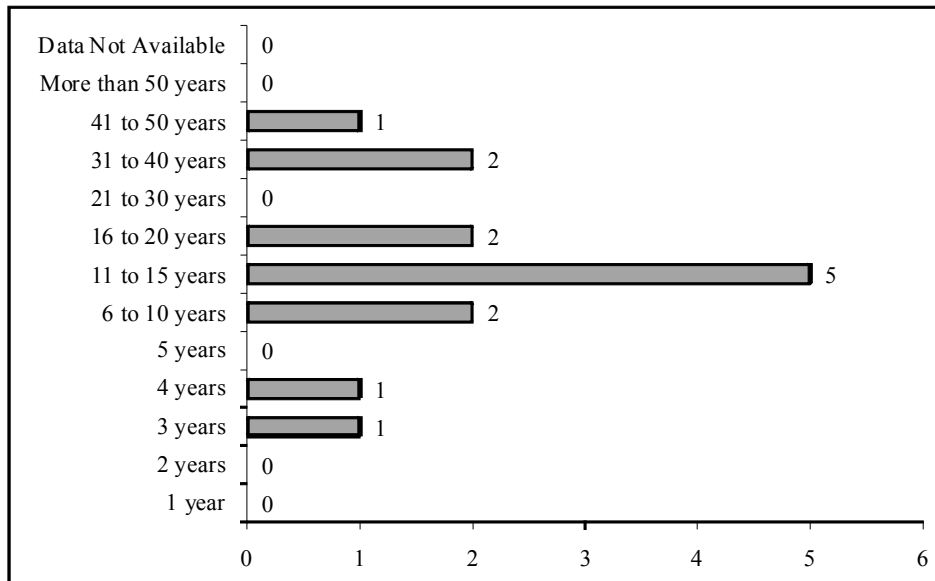
Figure 1: Number of Years the Companies has Established Office in Bangkok
(a): 100% Local
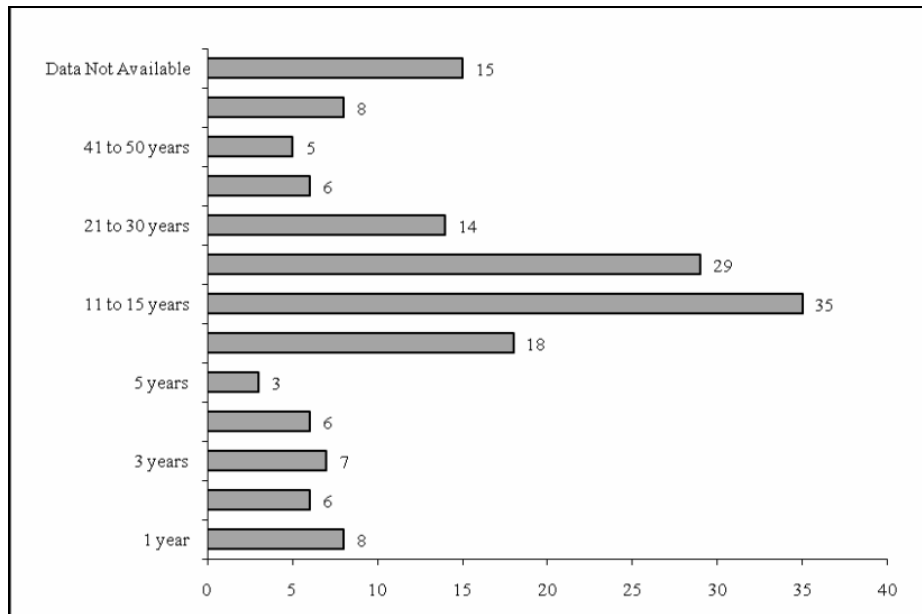
(b): 100% Foreign

(c) Joint venture

Source: Author

It can be observed from the above figures that most of the companies that participated in this survey have been established in Bangkok for 10 to 20 years. This reconfirms the credibility of the survey results and also provides a credible point of view regarding their future directions.

4.2. Business Activities

Most of the companies in this survey (almost half of those who responded) are involved in the manufacturing section as shown in Figure 2. The same trend is true for the domestic, foreign, and joint venture companies (Figures 3a, 3b and 3c). However, the local companies have more variety in their businesses such as wholesale, transportation and other service businesses; the foreign companies were also into retail and IT/software; while joint venture companies were also engaged in telecommunications. Other businesses applying across the three categories include agricultural export, engineering consultancy, security brokerage, refined alcohol, hospital service, and research and development (R&D).

Figure 2: Main Business Activities of the Respondents
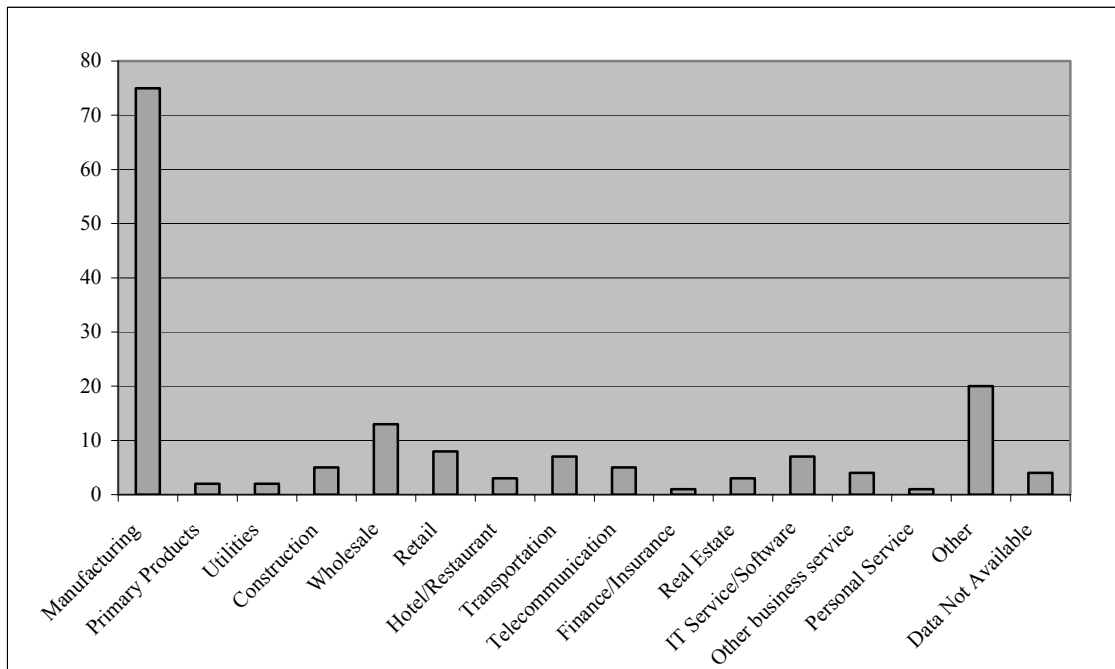
Source: Author.

Figure 3: Main Business Activities in Thailand
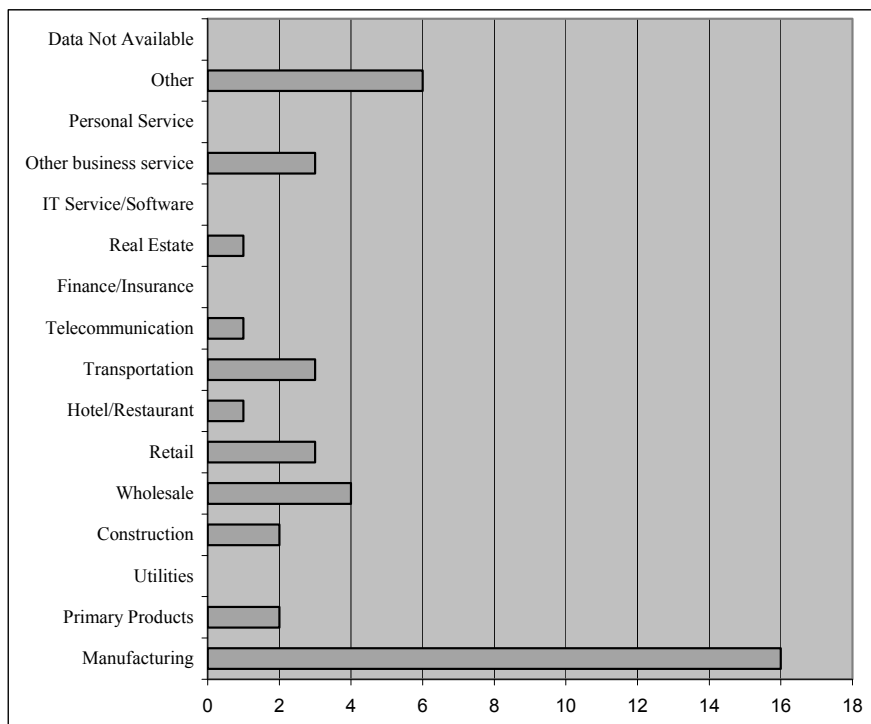
(a) 100% Local

(b) 100% Foreign
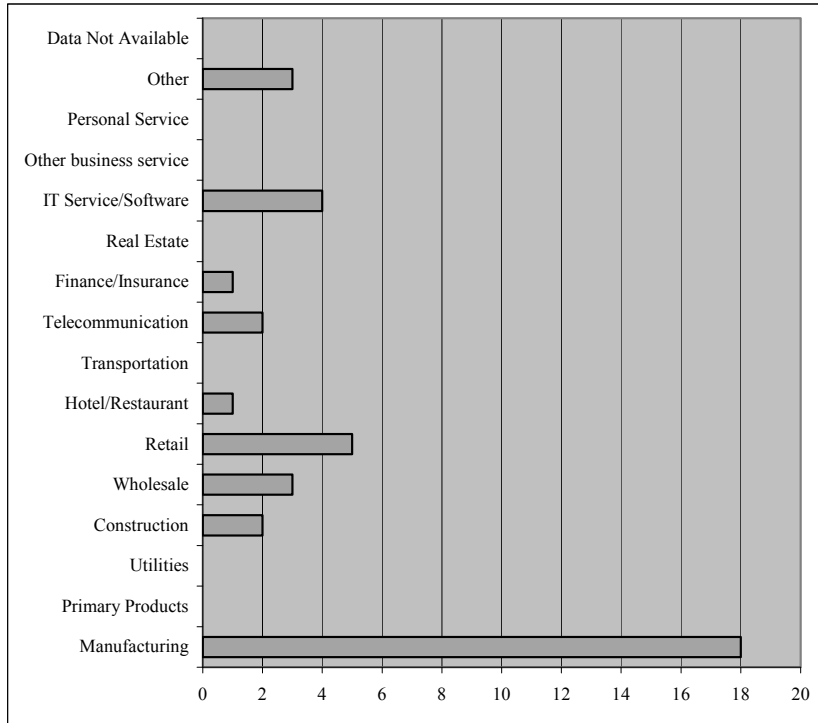
(c) Joint Venture
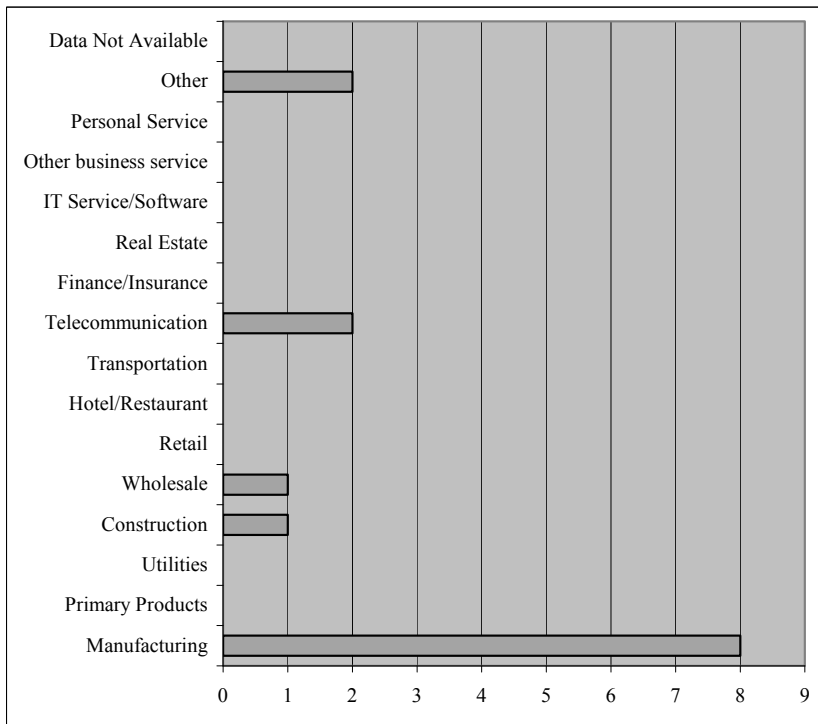
Source: Author.

4.3. Markets and Sources of Raw Materials

From various economic reports, most products produced in Thailand are supplied to or marketed locally; the result of this survey provided the same information. The companies in all three categories of have the same target market (local) and they also access most of their raw materials locally shown in Figures 4, 5 and 6. However, foreign companies have a better understanding of other countries' markets. It can be seen that foreign and joint venture companies' target and source of input are not only domestic, but also partially other countries – either ASEAN, other Asian countries, or even the US and EU as seen in Figures 5 and 6. Fig 4 is 100%local; Fig 5 is 100% foreign- owned; Fig 6 is joint ventures. The joint ventures do not market to or access inputs from the US.

One observation is that very few companies target China as their market country; this is probably because most of the major companies already have their companies established in China. Another observation is that although China has a good reputation in low cost of supply, there are only a few suppliers from China that supply to business in Thailand.

Figure 4: Target Market and Source of Raw Material for 100% Local Companies
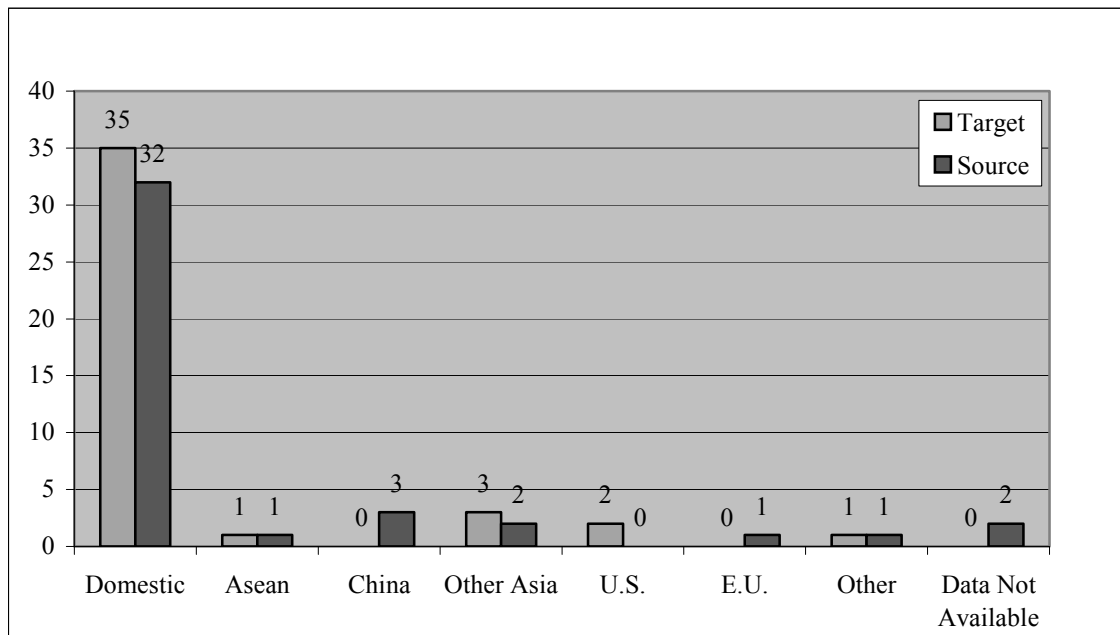
Source: Author.

Figure 5: Target Market and Source of Raw Material for 100% Foreign Companies
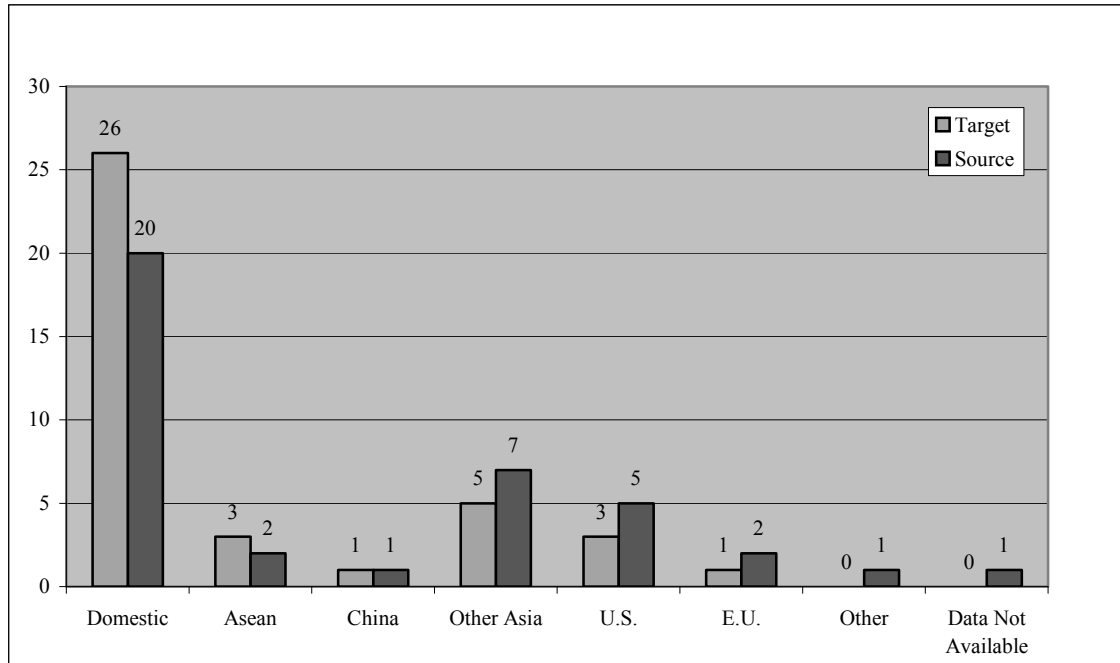
Source: Author.

Figure 6: Target Market and Source of Raw Material for Joint Venture Companies
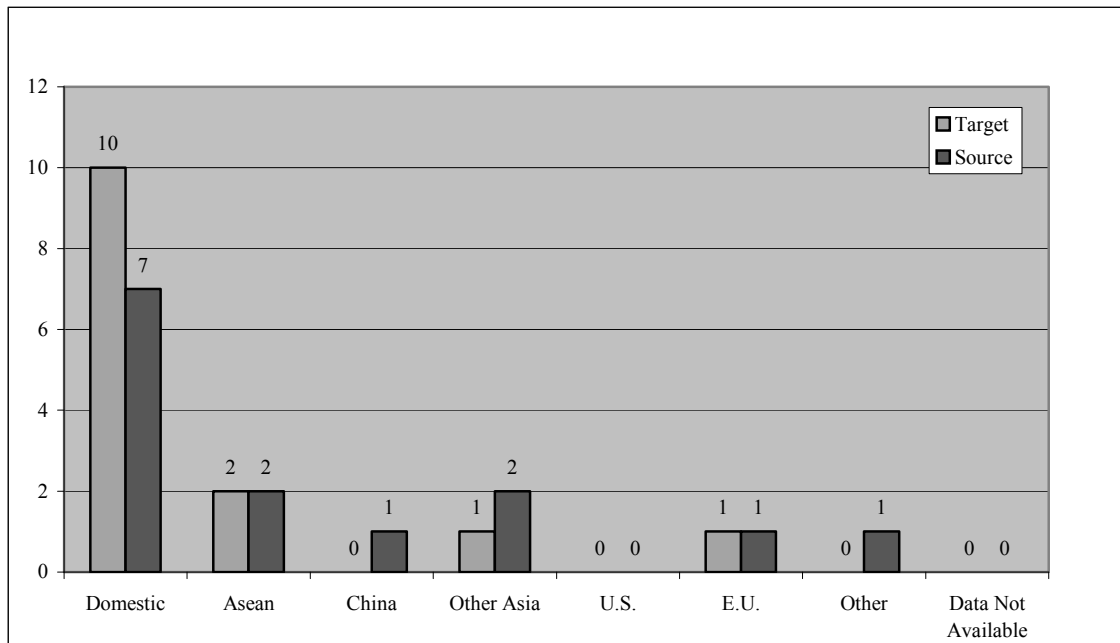
Source: Author.

4.4. Factors Affecting Business

There are several factors that might affect the flow of business procedure. Twenty (20) factors were selected for study, shown in the Table 1.

4.4.1. Most Important Factor

From Figures 7 and 8 for local and foreign companies, Factor 12, size of local market, is the most important factor. From the previous section, it was clear that most businesses supplied their products and services locally, therefore, having local market as the first consideration in doing business is logical. Another factor that ranks quite high is Factor 1, investment incentive including tax incentive that is also a significant factor in the models of econometric analysis since several companies are members of the BOI. Under BOI's contract, companies are allowed to import raw materials tax-free and have tax deductions during the earlier years. This greatly decreased their raw material costs at the initial stages of their businesses, which also increased their profits.

Table 1: Factors Affecting the Business for Present and Future
(Used for questions 7 and 8 in the mailed survey questionnaire)

| Number	Influential Factor
F1	investment incentives including tax incentives
F2	liberal trade policy
F3	customs procedures
F4	local content requirements, rule of origin
F5	physical infrastructure (roads, highways, ports, airports, etc.)
F6	infrastructure (telecommunications, IT)
F7	infrastructure (electricity, water supply, other utilities)
F8	government institutional infrastructure
F9	financial system
F10	legal system
F11	protection of intellectual property rights
F12	size of local markets
F13	access to export markets
F14	proximity to suppliers/subcontractors
F15	request by large/related company
F16	availability of low-cost labor
F17	availability of skilled labor and professionals
F18	other companies from the same country are located here (synergy)
F19	access to cutting-edge technology and information
F20	living conditions

Figure 7: The Important Factor of Present and Future for 100% Local Companies
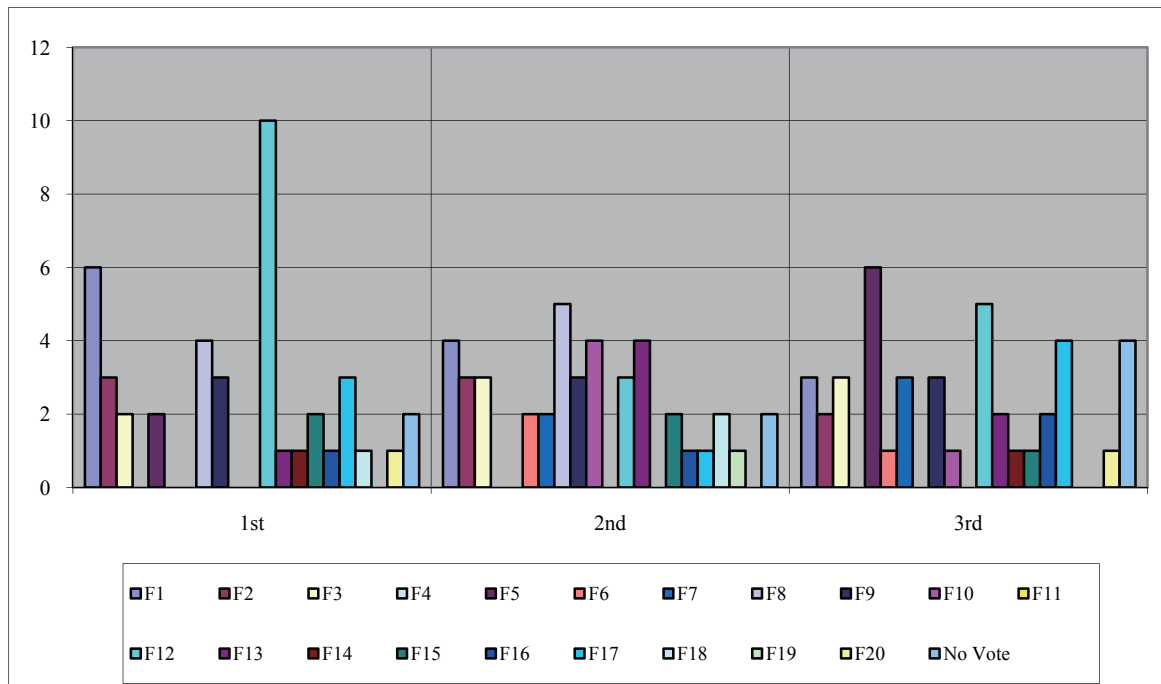
Note: See Table 1 for details on the legend.
Source: Author.

Figure 8: The Important Factor of Present and Future for 100% Foreign Companies

Note: See Table 1 for details on the legend.
Source: Author.

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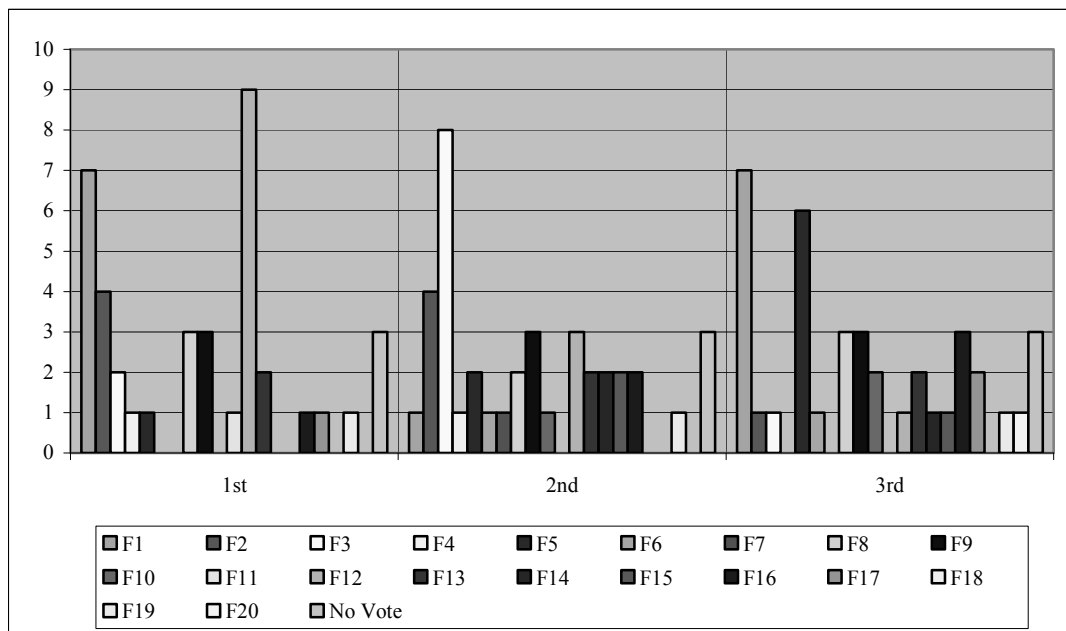
Figure 9: The important Factor of Present and Future for Joint Venture Companies
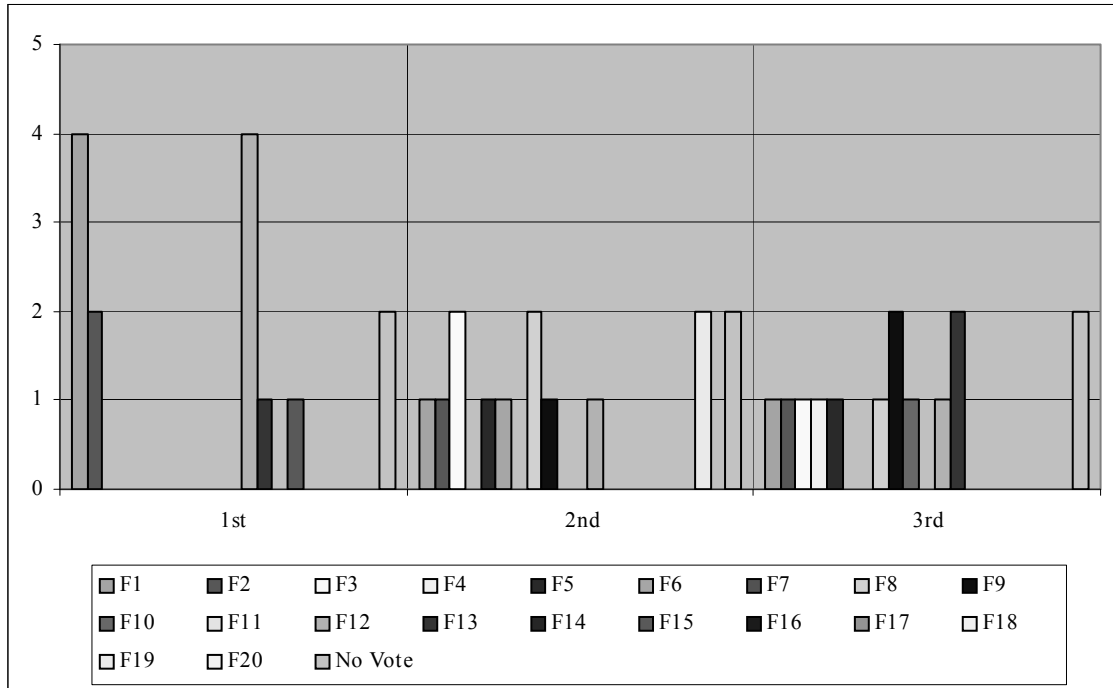
Note: See Table 1 for details on the legend.
Source: Author.

4.4.2. Second Most Important Factor

Regarding the second important factor, local companies focused on Factor 8, government institutional infrastructure, while foreign companies focused on Factor 3, customs procedures. Local companies live in Thailand, their home country; they would not want to move their businesses to other countries unless necessary. Therefore, how organized the government is determines how stable their business life is.

On the other hand, the foreign companies already have investments in other countries. It does not make much difference if they are to move to a different country, as long as it promises better revenues. Therefore, they are more concerned about customs procedures that can affect their convenience in doing business, which includes both import and export. Foreign companies' targets are partially other countries, therefore, customs procedures will greatly affect their business interests. Complicated procedures can delay their logistics plan.

For the second important factor, joint venture companies had shown quite an

interesting choice as shown in Figure 9; they selected both Factors 3 and Factors 8 as equally important. This answer however is quite logical since the companies in this group consist of both local and international investors. Therefore, it can be deduced that the important factors for consideration vary according to ownership of the companies.

4.5. Levels of Satisfaction

The next three figures, Figures 10, 11 and 12, showed the satisfaction level of each category of companies for the 20 factors affecting their businesses. From the figures, all three categories of companies showed that they still were not satisfied with Factor 8, government institutional infrastructure. Irrespective of the nature of the companies, it can be explained that they are all worried about Thailand's political situation. They show great concern and lack of confidence.

Figure 10: Satisfaction Level of Each Factor for 100% Local Companies
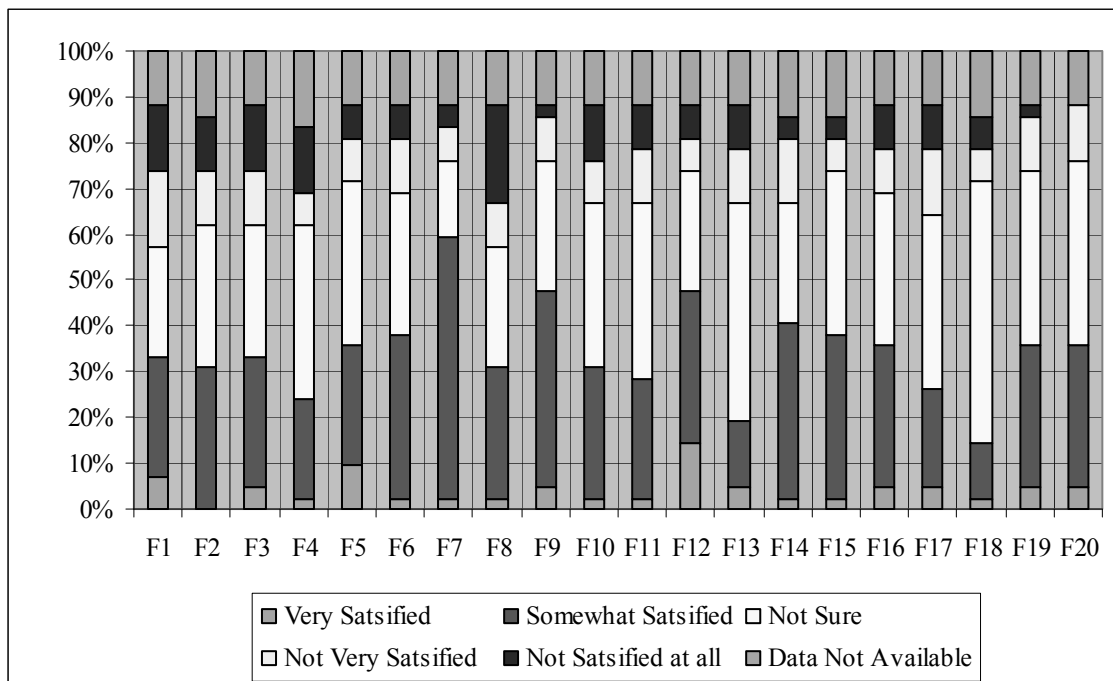
Source: Author.

Figure 11: Satisfaction Level of Each Factor for 100% Foreign Companies
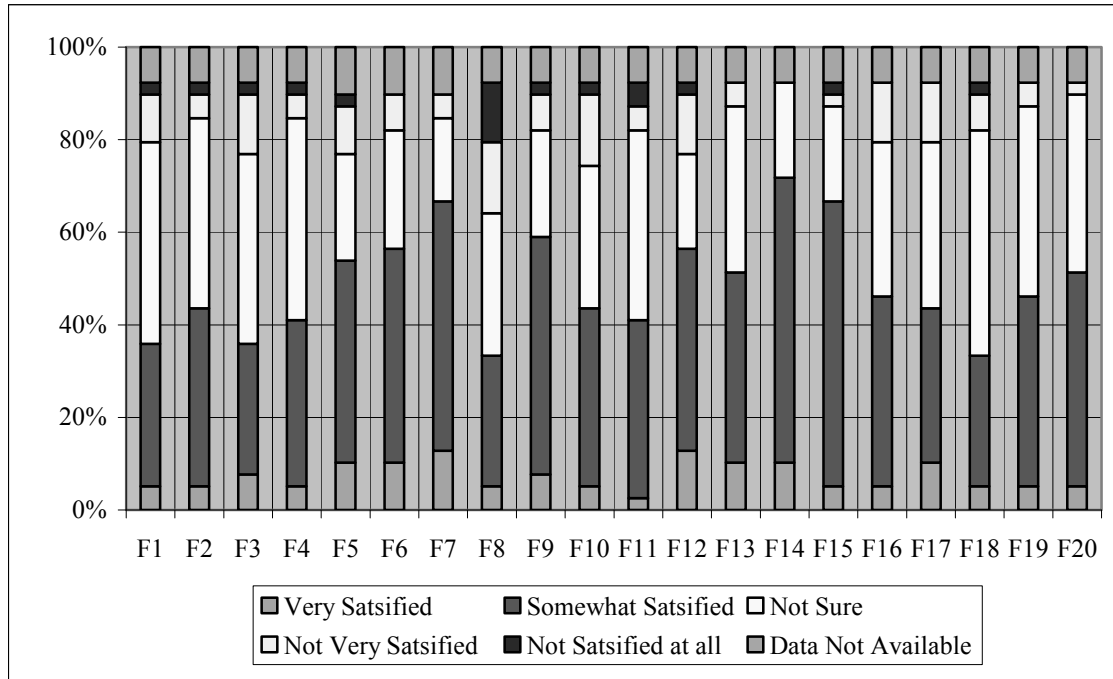
Source: Author.

Figure 12: Satisfaction Level of Each Factor for Joint Venture Companies
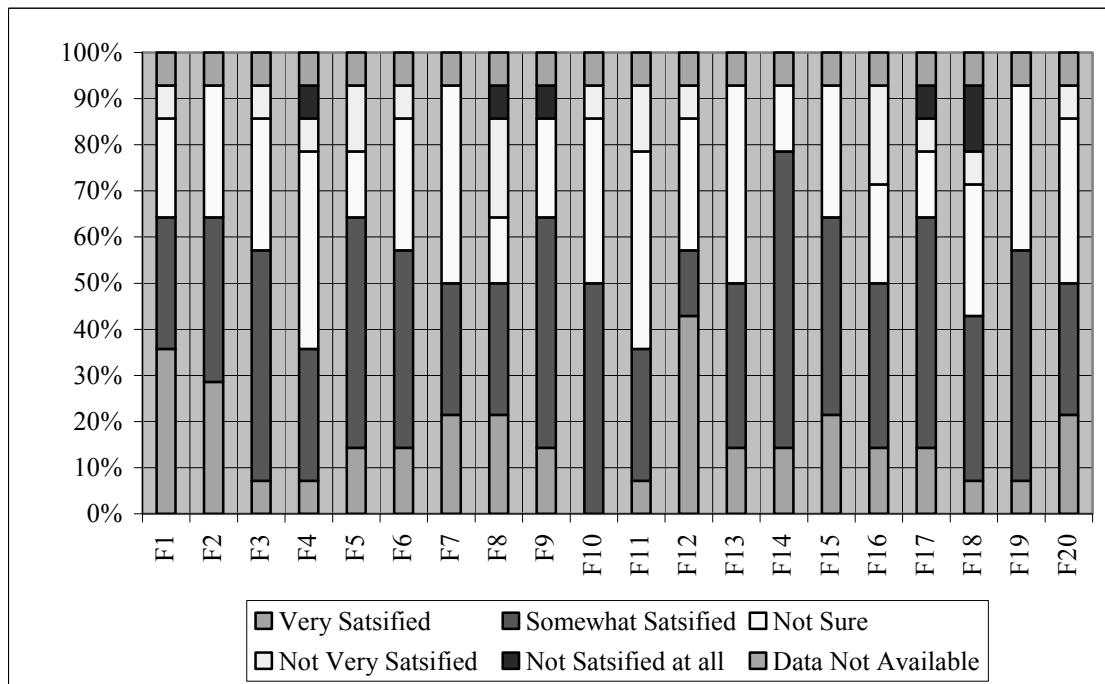
Source: Author.

However, in Figure 12, joint venture companies indicated a high dissatisfaction regarding Factor 18, other companies from the same country is located here (synergy). This is quite interesting. This may be explained as they need more companies from their home countries in the same cluster to be here in Thailand. However, according to theory of scarcity, companies should prefer being the only one with negotiating position. In this case, what they need may not be the companies from their countries with the same types of products. It may be because they are wishing for some suppliers from their own countries to setup their office in Thailand, either to shorten the transportation period or to access their trusted suppliers.

4.6. Future Plans

The companies' future plans will reflect how satisfied they are in Thailand; such plans also include how much further or bigger investment they are planning to deploy.

4.6.1. New Products, New Production Process, New Market and New Source of Supply

Figure 13 shows that even with some dissatisfaction with most of the factors, companies across the three categories are all planning to introduce new goods and products in Thailand. This implies that Thailand still has certain potential markets that each business is looking forward to.   However, many local companies show that they are not searching for new sources of supply (Figure13a). Foreign companies are looking for the new market (Figure 13b). Joint venture companies show the most interest in Thailand's market (Figure 13c). They are willing to invest in new market, new technology for production and even find new suppliers.

4.6.2. Probability of Expansion in Thailand

When companies were asked whether they would expand their office in Bangkok, the response varied. Local companies showed great interest in expansion, as seen in Figure 14. More than 50 percent of local companies are planning to do so ("yes" and "probably yes"). On the other hand, foreign companies show resistance in doing so. Eighteen out of 39 companies are interested, while 16 said they would not and another 5 were undecided. So foreign companies were not very sure whether they should expand

their business in Bangkok.

The same trend is shown by joint venture business, about half said "yes" to plans for expansion while the other half is either not sure or are not going to. This shows that although foreign investors are happy to maintain their businesses and promote new products in Thailand, still they do not have solid confidence in Thailand. The reasons are as shown from previously section regarding political infrastructure and custom procedure.

Figure 13: Future Deployment in Thailand
(a) 100% Local
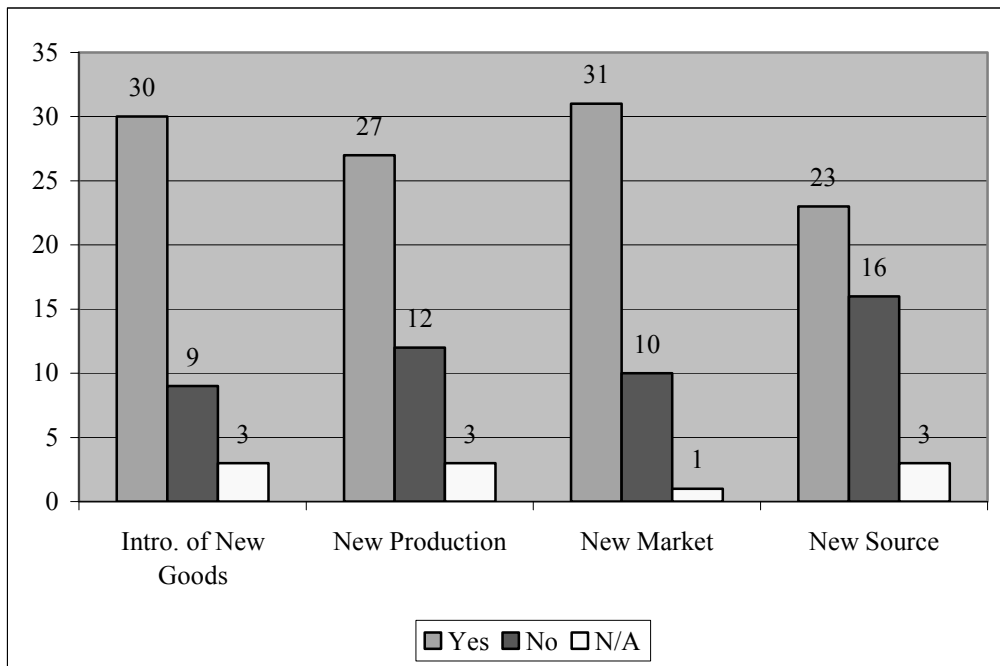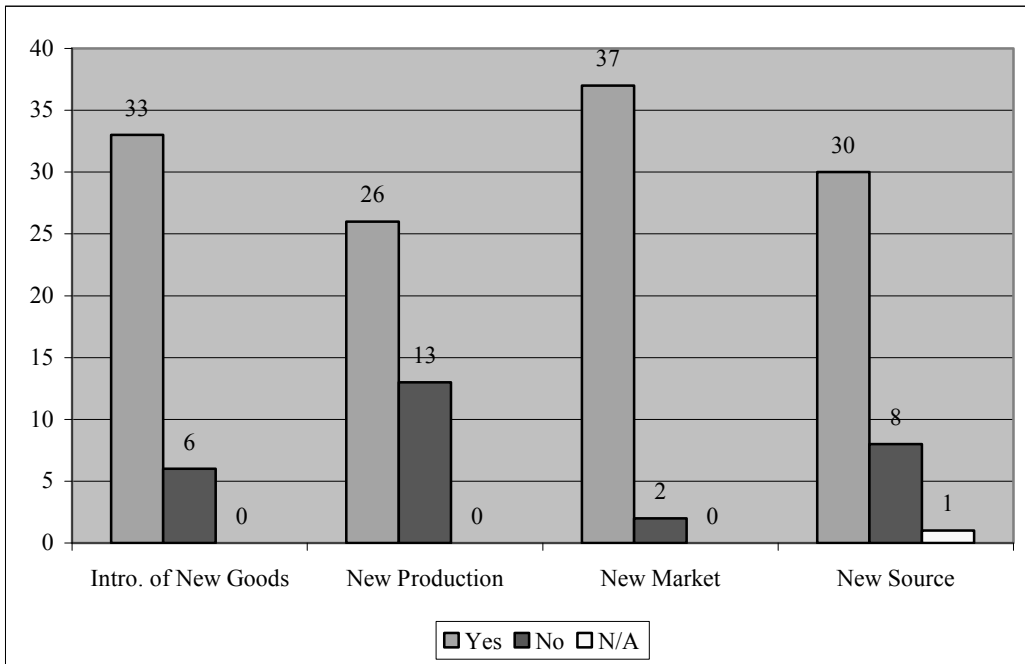
(b) 100% Foreign
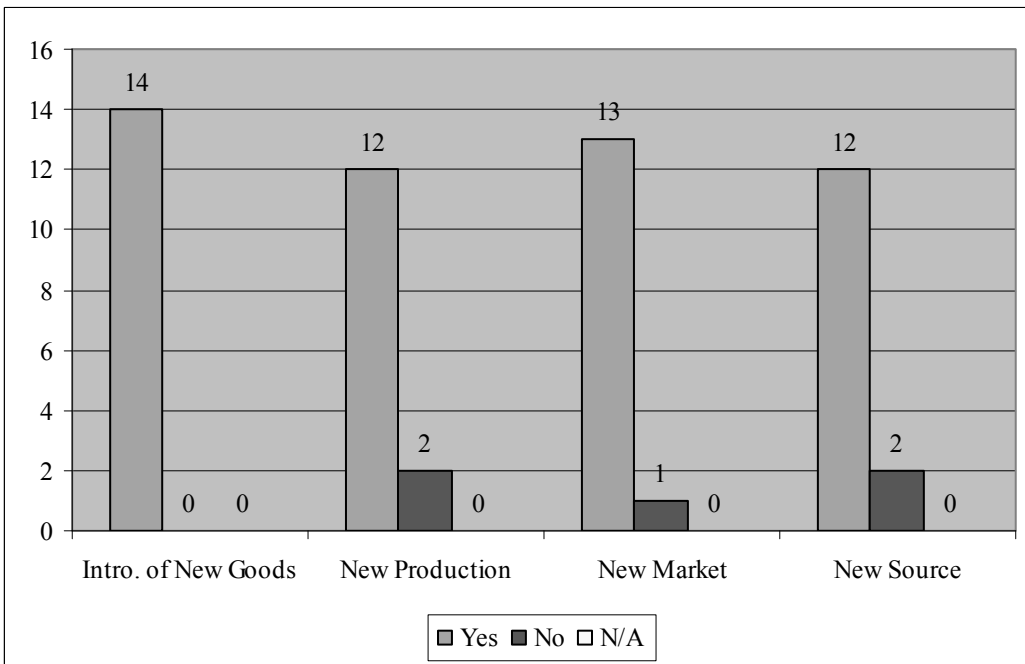
(c) Joint Venture

Source: Author.

Figure 14: Probability of Further Expansion in Bangkok

(a) 100% Local
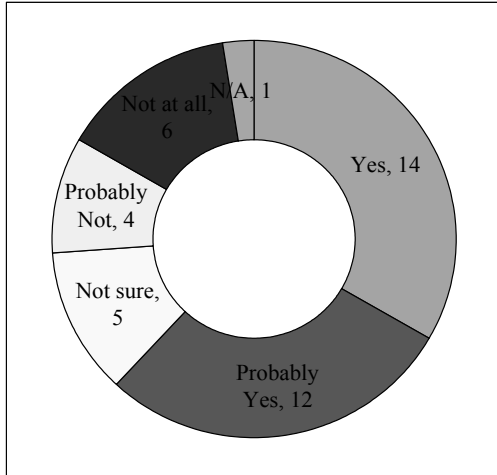
(b) 100% Foreign
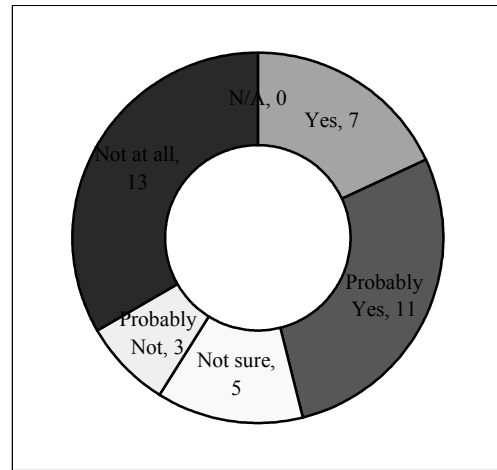
(c) Joint Venture
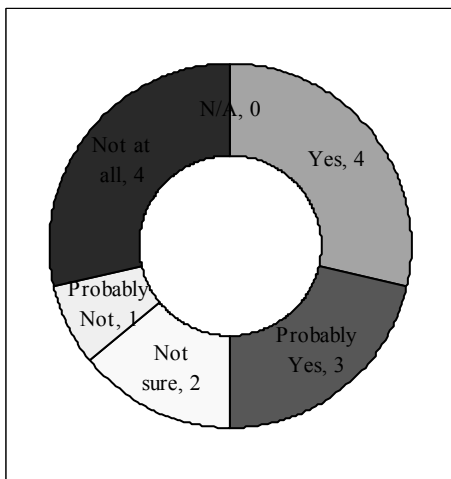
Source: Author.

5. ECONOMETRIC ANALYSIS FROM THE SURVEY DATA

5.1. Agglomeration

Based on the econometric analysis, the years of establishment of firms in Thailand can be divided into three periods according to the trend in accumulation as follows: 1) before 1985; 2) 1986-1998; and 3) after 1999, as seen in Figure 15. This result agrees

with the previous research done in 2005 by Tsuji, M., Y. Ueki, M. Miyahara and K. Somrote.

Figure 15: Accumulated Number of Offices Established in Thailand
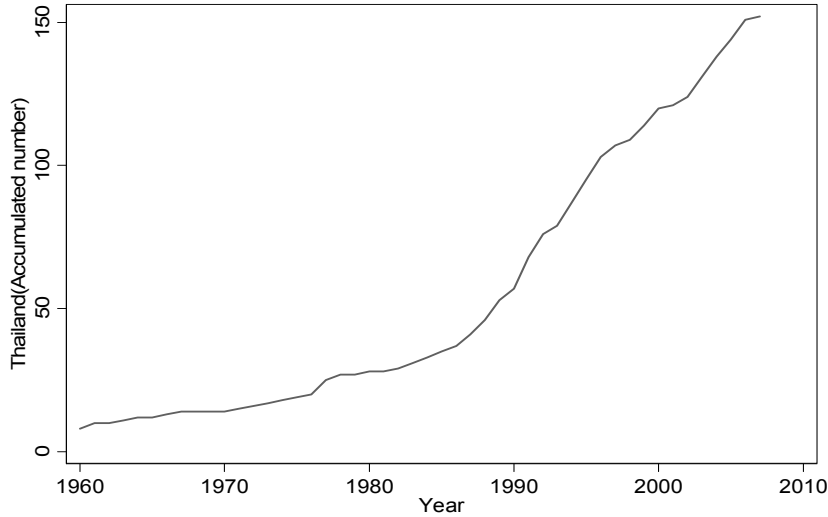
Source: ERIA Research Project Mail Survey 2007.

The model used to explain agglomeration in Thailand defined year of establishment of the firm as the dependent variable. Size of firms, influential factors, and functions of an office in Bangkok are used as independent variables, as seen in Equation 1, (Eq.1). The number of employees, firm's assets and paid-in capital explains the size of the firm as shown in Equations 1.1, 1.2 and1.3 respectively.

YoE = f(firm's size, influential factors, function of an office) (Eq.1)

YoE = f(The number of employees, influential factors, function of an office) (Eq.1.1)

YoE = f(firm's asset, influential factors, function of an office) (Eq.1.2)

YoE = f(paid-in capital, influential factors, function of an office) (Eq.1.3)

    where

YoE = year of establishment

Table 2: Results of Estimations: Agglomeration

			Employees		Assets		Capital	
			Full model	Selected model	Full model	Selected model	Full model	Selected model
Q3)	2	10,000-24,999(US$)/10,000-24,999 (US$)		[+]				
	3	100 - 199/25,000-49,999/25,000-49,999			*	**	*	**
	4	200 - 299/50,000-74,999/50,000-74,999						
	5	300 - 399/75,000-99,999/75,000-99,999	*	+	*			
	6	400 - 499/100,000-499,999/100,000-499,999						
	7	500 - 999/500,000-999,999/500,000-999,999					[*]	[**]
	8	1,000 - 1,499/1 M-4.9M/1M-4.9M						
	9	1,500 - 1,999/5M-9.9 M/5M-9.9M	[*]	[**]				
	10	2,000 & above/10M & above/10M & above						
Q8)	1	Investment incentives including tax incentives	[**]	[**]	[**]	[**]	[**]	[**]
	2	Liberal trade policy	**	**	**	*	**	**
	3	Customs procedures	+	*		+	+	*
	4	Local content requirements, rule of origin		[+]				[+]
	5	Physical infrastructure (roads, highways, ports, airports, etc.)	+	[+]	[+]	[+]	[**]	[**]
	6	Infrastructure (telecommunications, IT)		**		**	+	*
	7	Infrastructure (electricity, water supply, other utilities)		+			+	**
	8	Government institutional infrastructure						
	9	Financial system						
	10	Legal system	[**]	[**]	[**]	[**]	[**]	[**]
	11	Protection of intellectual property rights	**	**	**	*	**	**
	12	Size of local markets						
	13	Access to export markets						
	14	Proximity to suppliers/subcontractors						
	15	Request by large/related company						
	16	Availability of low-cost labor						
	17	Availability of skilled labor and professionals	[*]	[**]	[+]	[**]	[**]	[**]
	18	Other companies from the same country are located here (synergy)						
	19	Access to cutting-edge technology and information						
	20	Living conditions						
Q6)	1	Retail/ Wholesale trade	[**]	[**]	[**]	[**]	[**]	[**]
	2	Production (raw-material processing)			*			
	3	Production (components and parts)						[*]
	4	Production (final products)						[*]
	5	Purchasing/ Procurement/ Logistics						
	6	R&D/ Consulting						
	7	Human resources development	**	[**]	**	**	**	**
Nob			136	143	136	145	136	142
Log likelihood			-110.674	-126.518	-112.496	-131.094	-109.073	-121.714
Pseudo R2			0.199	0.156	0.186	0.138	0.21	0.184

Note 1: [ ] indicates that the coefficient is negative, and items without [] imply the coefficient is positive.
Note 2: **, * and + indicates that coefficient is at the 5, 10 and 20% significance level, respectively.
Source: ERIA Research Project Mail Survey 2007.

By analyzing the significance of the model as shown in Table 2, it can be concluded that for large companies who came earlier, "investment incentive," "legal system" and "availability of skilled labor and professionals" are the significant factors that encouraged investors to establish their business in Thailand. The function of the office in Bangkok for large firms at the beginning was more related to retail and wholesale trade. For smaller firms who usually came later after the large firms, the significant factors for their concerns when establishing their business are "liberal trade policy" and "protection of intellectual rights." In the Flowchart Approach, establishment of larger firms is very important since it is the starting point of agglomeration. However, the formation of the smaller firms around the large ones is important as well since this formation can develop into an industrial agglomeration later.

From the previous findings, it can be explained that the industrial agglomeration of Thailand could be divided into two stages. At the earlier stage, the large companies due to the attractive investment incentives, legal systems and skilled labor established firms related to sales activities in Thailand. At the later stage, attracted by the country's liberal trade policy and the system of intellectual property rights, smaller firms followed suit.

5.2. Upgrading and Innovation

For upgrading or innovation of the agglomeration on Thailand, binary models were used to explain the situation. The upgrading, influential factors and functions of the office in Bangkok are used as independent variables, as seen in Equation 2. The upgrading is defined in terms of new goods, new production methods and new sources of raw materials supply as shown in Equations 2.1, 2.2 and 2.3, respectively.

UoI = f(upgrading, influential factors, function of an office)   (Eq.2)

UoI = f(new goods, influential factors, function of an office)   (Eq.2.1)

UoI = f(firm's asset, influential factors, function of an office)   (Eq.2.2)

UoI = f(paid-in capital, influential factors, function of an office)   (Eq.2.3)

    where

UoI = whether there is an upgrading or innovation of a firm.

UoI = 0. It means there is no upgrade or no innovation.

UoI = 1. It means there is upgrade or no innovation.

The result for the analysis is shown in Table 3. It shows that the key variables do not robust to different models. Therefore, it is hard to draw the common factors for upgrading and innovation of Thai industrial agglomeration. However, some of the positive significant factors for upgrading are "local content," "legal systems," "proximity to suppliers and subcontractors" while "financial systems" is a negative significant factor.

Table 3: Results of Estimations: Upgrading and Innovation

			New goods		New method		New market		New supply	
			Full model	Selected model	Full model	Selected model	Full model	Selected model	Full model	Selected model
Q10)	1	incentives			[**]	[**]	[**]	[**]		
	2	Liberal trade policy			*	+	+	**		
	3	Customs procedures	+	+						
	4	Local content requirements, rule of origin					[*]	[**]	**	**
	5	Physical infrastructure(roads, highways, ports,airports, etc.)	*	**						
	6	Infrastructure(telecommunications, IT)		[+]						
	7	Infrastructure (electricity,water supply, other utilities)								
	8	Government institutional infrastructure								
	9	Financial system	[**]	[**]	[**]	[*]	[*]	[**]	[+]	
	10	Legal system	*	*			+	**		
	11	Protection of intellectual property rights							[+]	
	12	Size of local markets							[+]	[**]
	13	Access to export markets			**	**			+	
	14	Proximity to suppliers/subcontractors		+	+		**	**	+	
	15	Request by large/related company	**	**			[*]	[**]		
	16	Availability of low-cost labor								
	17	professionals								
	18	Other companies from the same country are located here (synergy)	[+]	[*]	[+]	[+]	[+]			
	19	Access to cutting-edge technology and information	**	[**]	[+]					
	20	Living conditions	+	*						
Q6)	1	Retail/ Wholesale trade	+	*						
	2	Production (raw-material processing)	[*]						[+]	[+]
	3	Production (components and parts)							*	**
	4	Production (final products)	[+]						+	*
	5	Purchasing/ Procurement/ Logistics	[**]	[**]						
	6	R&D/ Consulting	**	**						
	7	Human resources development			[+]	[+]	*	**	[+]	[**]
Q1)		When did your company establish its first office?			[**]	[**]				[+]
		_cons		[*]	**	**		**		+
Obs			123	129	122	127	122	128	122	129
Log likelihood			-40.302	-46.606	-58.682	-66.867	-49.481	-57.632	-61.608	-70.965
Pseudo R2			0.389	0.309	0.264	0.196	0.301	0.211	0.26	0.191

Note 1: [ ] indicates that the coefficient is negative, and items without [ ] imply the coefficient is positive.
Note 2: **, * and + indicates that coefficient is at the 5, 10 and 20% significance level, respectively.
Source: ERIA Research Project Mail Survey 2007.

6. CONCLUSION

In conclusion, the industrial agglomeration of Thailand can be divided into three periods (before 1985, 1986-1998 and after 1999). The earlier establishment of the large firms who were attracted by investment incentives, legal systems and skilled labor, the smaller firms – who were also satisfied with the government policies in liberal trade and the system of intellectual property rights – to form themselves around the large firms. Although the result of descriptive statistics show that there are several upgrading of the firms in term of new goods, new production methods and new sources of raw materials supply; the common factor that supports the upgrading is hard to find.

The Thai government has tried hard to support agglomeration. The government's policies have been changed to determine the right combination of top-down and bottom-up approaches in promoting agglomeration. Not only by providing investment incentive as usual, but also improving all systems that involve industrial investments to be more standard but at the same time also reasonably flexible. Also, several agencies have been established for pointing the government policy into the right direction. Promoting the development of agglomeration is a never-ending task of the government. However, maintaining of the existing agglomerations is also very important. Based on the interviews with the companies, it is found that the weakness of Thai agglomeration is the lack of enough R&D. With R&D, the industrial agglomeration can be strengthened so it can survive in the competitive world of business and industry.

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APPENDIX

Here, detailed results of estimation are presented. Table A1 and A2 show those for agglomeration, and Table A3 and A4 for upgrading and innovation.

Table A1: Estimation of Agglomeration (Thailand): Full Model

		Full-time Employees		Total Assets		Paid-UP Capital	
		Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
Q3)	2) 50-99persons/10,000-24,999(US$)/10,000-24,999 (US$)	-0.764	-1.000	-0.216	-0.300	1.005	1.130
	3) 100 - 199/25,000-49,999/25,000-49,999	-0.532	-0.620	1.149	1.690 *	1.160	1.700 *
	4) 200 - 299/50,000-74,999/50,000-74,999	0.386	0.440	-0.531	-0.530	-1.006	-1.000
	5) 300 - 399/75,000-99,999/75,000-99,999	3.328	1.740 *	0.499	0.520	-1.526	-1.270
	6) 400 - 499/100,000-499,999/100,000-499,999	0.292	0.310	0.390	0.520	0.197	0.280
	7) 500 - 999/500,000-999,999/500,000-999,999	-0.147	-0.140	1.001	1.120	-1.773	-1.330 *
	8) 1,000 - 1,499/1 M-4.9M/1M-4.9M	-0.197	-0.200	0.180	0.250	0.572	0.850
	9) 1,500 - 1,999/5M-9.9 M/5M-9.9M	-1.550	-1.780 *	0.944	0.830	1.067	0.830
	10) 2,000 & above/10M & above/10M & above	-0.458	-0.660	0.578	0.720	0.663	0.970
Q7)	1) Investment incentives including tax incentives	-0.561	-2.310 **	-0.704	-2.960 **	-0.738	-2.980 **
	2) Liberal trade policy	0.525	2.350 **	0.459	2.090 **	0.665	2.840 **
	3) Customs procedures	0.345	1.590 +	0.231	1.080	0.298	1.390 +
	4) Local content requirements, rule of origin	-0.160	-0.790	-0.040	-0.190	-0.106	-0.520
	5) Physical infrastructure (roads, highways, ports, airports, etc.)	-0.437	-1.320 +	-0.514	-1.630 +	-0.649	-1.980 **
	6) Infrastructure (telecommunications, IT)	0.347	1.130	0.257	0.860	0.404	1.380 +
	7) Infrastructure (electricity, water supply, other utilities)	0.341	1.250	0.320	1.170	0.382	1.400 +
	8) Government institutional infrastructure	0.150	0.510	0.141	0.480	0.149	0.500
	9) Financial system	-0.127	-0.420	0.096	0.330	0.109	0.370
	10) Legal system	-0.811	-2.420 **	-0.750	-2.200 **	-0.848	-2.470 **
	11) Protection of intellectual property rights	0.524	1.980 **	0.530	2.030 **	0.620	2.250 **
	12) Size of local markets	-0.045	-0.200	-0.033	-0.150	-0.002	-0.010
	13) Access to export markets	-0.084	-0.390	-0.017	-0.080	-0.155	-0.730
	14) Proximity to suppliers/subcontractors	0.230	0.860	0.061	0.240	0.220	0.840
	15) Request by large/related company	0.126	0.540	0.221	0.940	0.211	0.910
	16) Availability of low-cost labor	-0.156	-0.650	-0.220	-0.980	-0.041	-0.170
	17) Availability of skilled labor and professionals	-0.517	-1.780 *	-0.428	-1.540 +	-0.666	-2.310 **
	18) Other companies from the same country are located here (synergy)	0.149	0.660	0.173	0.780	0.100	0.460
	19) Access to cutting-edge technology and information	0.181	0.720	-0.055	-0.220	-0.024	-0.100
	20) Living conditions	-0.142	-0.540	-0.051	-0.200	-0.137	-0.520
Q6)	1) Retail/ Wholesale trade	-1.943	-3.760 **	-1.760	-3.470 **	-1.994	-3.890 **
	2) Production (raw-material processing)	-0.915	-1.270	-1.166	-1.650 *	-0.741	-0.960
	3) Production (components and parts)	-0.615	-0.930	-0.127	-0.200	-0.029	-0.040
	4) Production (final products)	-0.617	-1.250	-0.462	-0.910	-0.514	-1.000
	5) Purchasing/ Procurement/ Logistics	-0.509	-0.810	-0.229	-0.370	-0.230	-0.360
	6) R&D/ Consulting	-0.423	-0.600	-0.313	-0.440	-0.362	-0.530
	7) Human resources development	2.242	2.310 **	2.015	2.210 **	2.341	2.330 **
	/cut1	-3.548		-3.573		-3.206	
	/cut2	-0.316		-0.404		0.087	
Nob		136		136		136	
Log likelihood		-110.674		-112.496		-109.073	
Pseudo R2		0.199		0.186		0.210	

Note: **, * and + indicates that coefficient is at the 5, 10 and 20% significance level, respectively.

Table A2: Estimation of Agglomeration (Thailand): Selected Model

		Full-time Employees		Total Assets		Paid-UP Capital	
		Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
Q3)	2) 50-99persons/10,000-24,999(US$)/10,000-24,999 (US$)	-0.982	-1.640 +				
	3) 100 - 199/25,000-49,999/25,000-49,999			1.109	1.990 **	1.602	2.620 **
	4) 200 - 299/50,000-74,999/50,000-74,999						
	5) 300 - 399/75,000-99,999/75,000-99,999	2.407	1.370 +	1.433	1.650 *		
	6) 400 - 499/100,000-499,999/100,000-499,999						
	7) 500 - 999/500,000-999,999/500,000-999,999					-2.188	-2.270 **
	8) 1,000 - 1,499/1 M-4.9M/1M-4.9M						
	9) 1,500 - 1,999/5M-9.9 M/5M-9.9M	-1.526	-2.100 **				
	10) 2,000 & above/10M & above/10M & above						
Q7)	1) Investment incentives including tax incentives	-0.513	-2.820 **	-0.448	-2.580 **	-0.502	-2.690 **
	2) Liberal trade policy	0.463	2.330 **	0.317	1.720 *	0.596	2.810 **
	3) Customs procedures	0.349	1.780 *	0.247	1.380 +	0.343	1.760 *
	4) Local content requirements, rule of origin	-0.288	-1.640 +			-0.242	-1.330 +
	5) Physical infrastructure (roads, highways, ports, airports, etc.)	-0.427	-1.560 +	-0.344	-1.630 +	-0.788	-2.750 **
	6) Infrastructure (telecommunications, IT)	0.509	2.050 **	0.454	1.980 **	0.477	1.910 *
	7) Infrastructure (electricity, water supply, other utilities)	0.368	1.610 +			0.524	2.190 **
	8) Government institutional infrastructure						
	9) Financial system						
	10) Legal system	-0.664	-2.660 **	-0.483	-2.050 **	-0.786	-3.010 **
	11) Protection of intellectual property rights	0.426	2.010 **	0.372	1.840 *	0.571	2.520 **
	12) Size of local markets						
	13) Access to export markets						
	14) Proximity to suppliers/subcontractors						
	15) Request by large/related company						
	16) Availability of low-cost labor						
	17) Availability of skilled labor and professionals	-0.488	-2.390 **	-0.471	-2.400 **	-0.520	-2.510 **
	18) Other companies from the same country are located here (synergy)						
	19) Access to cutting-edge technology and information						
	20) Living conditions						
Q6)	1) Retail/ Wholesale trade	-1.509	-3.640 **	-1.293	-3.270 **	-2.008	-4.250 **
	2) Production (raw-material processing)						
	3) Production (components and parts)					-0.980	-1.720 *
	4) Production (final products)					-0.806	-1.820 *
	5) Purchasing/ Procurement/ Logistics						
	6) R&D/ Consulting						
	7) Human resources development	1.696	2.380 **	1.955	2.890 **	2.310	2.980 **
	/cut1	-3.391		-3.327		-4.037	
	/cut2	-0.692		-0.702		-1.263	
Nob		143		145		142	
Log likelihood		-126.518		-131.094		-121.714	
Pseudo R2		0.156		0.138		0.184	

Note: **, * and + indicates that coefficient is at the 5, 10 and 20% significance level, respectively.

Table A3: Results of Industrial Upgrading and Innovation (Thailand): Full Model

		New Goods		New Method		New Market		New Input	
		Coefficient	t-value	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
Q8)	1) Investment incentives including tax incentives	0.187	0.480	-0.870	-2.360 **	-1.011	-2.360 **	-0.061	-0.190
	2) Liberal trade policy	0.344	0.730	0.696	1.760 *	0.733	1.580 +	0.082	0.210
	3) Customs procedures	0.592	1.460 +	-0.127	-0.420	0.308	0.840	-0.007	-0.020
	4) Local content requirements, rule of origin	-0.331	-0.700	-0.193	-0.640	-1.026	-2.630 *	0.639	2.040 **
	5) Physical infrastructure (roads, highways, ports, airports, etc.)	1.242	2.610 *	0.444	1.250	0.273	0.660	0.152	0.440
	6) Infrastructure (telecommunications, IT)	-0.702	-1.180	0.127	0.320	-0.443	-0.900	-0.246	-0.620
	7) Infrastructure (electricity, water supply, other utilities)	-0.382	-0.590	-0.420	-0.940	-0.309	-0.560	0.060	0.140
	8) Government institutional infrastructure	0.087	0.210	0.052	0.160	0.159	0.460	0.148	0.470
	9) Financial system	-1.653	-2.570 **	-0.890	-2.120 **	-0.928	-1.910 *	-0.539	-1.440 +
	10) Legal system	0.884	1.740 *	0.283	0.780	0.595	1.500 +	0.233	0.680
	11) Protection of intellectual property rights	0.328	0.750	0.003	0.010	0.139	0.360	-0.510	-1.510 +
	12) Size of local markets	-0.294	-0.760	0.139	0.470	0.259	0.770	-0.492	-1.590 +
	13) Access to export markets	0.305	0.680	0.723	2.020 **	0.424	1.090	0.516	1.560 +
	14) Proximity to suppliers/subcontractors	0.466	1.020	0.578	1.480 +	1.276	2.620 **	0.476	1.310 +
	15) Request by large/related company	1.106	1.990 **	0.296	0.690	-0.921	-1.790 *	-0.064	-0.160
	16) Availability of low-cost labor	-0.035	-0.070	-0.040	-0.110	0.111	0.250	-0.017	-0.050
	17) Availability of skilled labor and professionals	-0.022	-0.050	-0.194	-0.560	0.252	0.590	-0.021	-0.060
	18) Other companies from the same country are located here (synergy)	-0.759	-1.630 +	-0.586	-1.470 +	-0.584	-1.420 +	-0.239	-0.680
	19) Access to cutting-edge technology and information	-1.036	-2.180 **	-0.486	-1.400 +	-0.264	-0.620	0.163	0.440
	20) Living conditions	0.660	1.400 +	0.074	0.200	0.066	0.150	-0.110	-0.290
Q6)	1) Retail/ Wholesale trade	1.374	1.590 +	0.517	0.810	-0.039	-0.060	0.465	0.840
	2) Production (raw-material processing)	-1.721	-1.660 +	0.315	0.340	-0.416	-0.430	-1.191	-1.510 +
	3) Production (components and parts)	-1.313	-1.230	0.067	0.080	0.344	0.340	1.652	1.880 *
	4) Production (final products)	-1.216	-1.460 +	-0.109	-0.170	0.139	0.180	0.964	1.620 +
	5) Purchasing/ Procurement/ Logistics	-2.566	-2.550 **	0.248	0.290	-1.023	-1.260	-0.382	-0.490
	6) R&D/ Consulting	4.442	2.480 **	0.468	0.500	0.775	0.670	-0.652	-0.790
	7) Human resources development	0.207	0.140	-1.961	-1.460 +	3.343	1.820 *	-1.887	-1.500 +
Q1)	1) When did your company establish its first office?	-0.024	-0.990	-0.046	-1.970 **	-0.017	-0.910	-0.017	-1.240
	constant	46.429	0.970	92.581	2.000 **	37.855	1.030	34.198	1.230
Nob		123.000		122		122		122	
Log likelihood		-40.302		-58.682		-49.481		-61.608	
Pseudo R2		0.389		0.264		0.301		0.260	

Note: **, * and + indicates that coefficient is at the 5, 10 and 20% significance level, respectively.

Table A4: Results of Industrial Upgrading and Innovation (Thailand): Selected Model

		New Goods		New Method		New Market		New Input	
		Coefficient	t-value	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
Q8)	1) Investment incentives including tax incentives			-0.640	-2.260 **	-0.786	-2.530 **		
	2) Liberal trade policy			0.478	1.460 +	0.839	2.450 **		
	3) Customs procedures	0.483	1.650 +						
	4) Local content requirements, rule of origin					-0.900	-2.870 **	0.744	3.160 **
	5) Physical infrastructure (roads, highways, ports, airports, etc.)	1.039	2.920 **						
	6) Infrastructure (telecommunications, IT)	-0.631	-1.610 +						
	7) Infrastructure (electricity, water supply, other utilities)								
	8) Government institutional infrastructure								
	9) Financial system	-0.933	-2.170 **	-0.547	-2.000 *	-0.678	-2.020 **		
	10) Legal system	0.672	1.770 *			0.729	2.170 **		
	11) Protection of intellectual property rights								
	12) Size of local markets							-0.570	-2.380 **
	13) Access to export markets			0.776	2.800 **				
	14) Proximity to suppliers/subcontractors	0.574	1.570 +			1.182	3.010 **		
	15) Request by large/related company	0.909	2.220 **			-0.823	-2.150 **		
	16) Availability of low-cost labor								
	17) Availability of skilled labor and professionals								
	18) Other companies from the same country are located here (synergy)	-0.635	-1.670 *	-0.425	-1.440 +				
	19) Access to cutting-edge technology and information	-0.760	-1.970 **						
	20) Living conditions	0.683	1.730 *						
Q6)	1) Retail/ Wholesale trade	1.227	1.700 *						
	2) Production (raw-material processing)							-1.141	-1.640 +
	3) Production (components and parts)							1.539	2.290 **
	4) Production (final products)							0.938	1.890 *
	5) Purchasing/ Procurement/ Logistics	-2.016	-2.660 **						
	6) R&D/ Consulting	2.693	2.280 **						
	7) Human resources development			-1.264	-1.540 +	3.201	2.250 **	-2.437	-2.560 **
Q1)	When did your company establish its first office?			-0.048	-2.230 **			-0.023	-1.510 +
	constant	-3.326	-1.730 *	97.196	2.270 **	2.567	1.970 **	44.981	1.500 +
Nob		129		127		128		129	
Log likelihood		-46.606		-66.867		-57.632		-70.965	
Pseudo R2		0.309		0.196		0.211		0.191	

Note: **, * and + indicates that coefficient is at the 5, 10 and 20% significance level, respectively.