# Innovation and Local Technological Capacity in Thai Natural Resource-Based Supply Chain

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### Abstract

Thailand has a strong domestic market and a growing middle class with a free-market economy and private sector being the main engine of growth. There are factors that have an influence on innovation in an industry in Thailand. The main objectives of this study are to examine those contributing factors in a domestic scale, especially in Thai natural resource-based production network. The study was conducted by interviewing the top management of the selected firms in three industries; rubber, textile, and furniture. The factors being considered are firm's characteristics, customer-driven, management support, human resource management, technology, innovation, production process, and location. The result of this study shows how innovation and technology influence the firm in Thailand industries.

### **1. Introduction**

Thailand is Southeast Asia's second largest economy with a gross domestic product (GDP) worth 365.56 billion US dollars in 2012. The gross domestic product (GDP) measures national income and output for a given country's economy, which is equal to the total expenditures for all final goods and services produced within the country in a stipulated period of time. According to the statistics (bank of Thailand), it shows that the GDP of manufacturing accounts for 39.2% of the overall GDP and agriculture accounts for 39.6% of overall labor which are the highest percentage of each sector as shown below. Other services account for 24.9% of GDP including financial sector, education, hotels and restaurants, etc.

### 1.1 Innovation

Innovations assist firms and businesses in the way of increasing their performance as they indicate the positive and negative effects of the business model. The general definition of an innovation is the implementation of a new or significantly improved product/service, or process, a new marketing method, or a new organizational method in business practices. Also supply chain collaboration is the method to support introspection of behavior and communication between the firms. According to Oslo Manual (OECD 2005), innovation can be categorized into 4 types, which consist of product innovation, process innovation, marketing innovation, and organizational innovation. The product/service innovation is the introduction of a new product including essential improvements, technical specification, components, materials, and other functional characteristics. Process innovation is the implementation of a new production method or delivery method (mainly focus on processes).

Then, marketing innovation is the new way of marketing the product, which also includes new markets and focus mainly on latest marketing processes. And, the last one is organizational innovation. It denotes new organizational method in the firm's business practices, workplace organization or external relations. Moreover, the level of innovation can be categorized into 2 types, which are radical innovation and incremental innovation. Radical innovation brings about a nonroutine activities change or major change; whereas incremental innovation is routine activities change or minor change (Thomas et al., 2011).

(build: Dank of Thanand)					
	GDP of sector (%)	Labor of sector (%)			
Manufacturing	39.2	13.8			
Wholesale and Retail Trade	13.4	15.4			
Transport, Storage and Communication	9.8	2.7			
Agriculture	8.4	39.6			
Construction and Mining	4.3	6.6			
Other Services *	24.9	21.9			

 Table 1 Structure of Economic in Year 2012
 (Source: Bank of Thailand)

### 1.2 Supply Chain Collaboration

Supply Chain Collaboration (SCC) can be described as an inter-organizational relationship in supply chain which the participating parties agree to invest resources, mutually achieve goals, share information, resources, rewards and responsibilities as well as jointly make decisions and solve problems (Soosay et al., 2008). There are four types of business relationship: Arm's length, Collaboration, Joint venture, and Vertical integration (Kampstra et al., 2006). Arm's length is a purely transactional relationship that does not have any degree of collaboration. Collaboration is not the same as joint venture and strategic alliance, which normally entail some degree of shared ownership across the party. Collaboration is also different from vertical integration in which all the members in the supply chain belong to the same owner. There are four forms of organizational coordination in supply chain: Dyadic, Channel integration, 3P-hub chain, and Vertical integration (Cooper et al., 1997; Cao et al., 2008).

#### 2. Methodology

First, we select three leading natural resources-based industries in Thailand. We interview sample companies that have effective systems and production processes, which are related to this research. The cross case comparison, including how the firms' characteristics are impact the innovation and knowledge transfer among firms. In this case, we study three industries to understand the strength and weakness in each type of industry in Thailand and clearly see the factor that creates collaboration. There are rubber industry, textile industry, and furniture industry. We choose the companies from the supply chain position which are upstream, midstream, and downstream. Moreover size is one of the factors that we consider such as small, medium, and large. The companies in rubber industry are Rubber farmer, Hihero CO.,LTD, Yokohama manufacturing Thailand, Thai rubber Latex Corporation, and Thai Hua CO.,LTD. The companies in textile industry are Sawang rungrueng textile CO.,LTD, RH Textile CO.,LTD, PP. Textile CO.,LTD, Teijin Polyester CO.,LTD, and Luckytex Public CO.,LTD. The companies in furniture and wood industry are Thanawat company, Teerawat Timber CO.,LTD, P.Kijsiri furnishing, SEP worldwide, and Sudsawad Thai Plywood CO.,LTD.

### **3. Overview Industry**

#### 3.1 Rubber industry

Rubber is very important industry in Thailand, not only for consumption in Thailand but also for export to the global market. Major rubber products manufactured in Thailand include Transformed Rubber (such as rubber smoked sheets (RSS), Concentrated Latex, Stick Thai Rubber (STR), other natural rubber), and Compound Rubber or Rubber Product (such as Tire for motorcars, Elastic, Glove and other products).

Thailand is the number one exporter of natural rubber in the world and rubber is the number four among all export industries of Thailand that sells 80,000 million baht as 4.2%. In terms of

association, they have THE THAI RUBBER ASSOCIATION to support export of Thai rubber to be the world's leader. First of all, Thailand has nice land that can grow the rubber trees. Second, Thailand has the best quality species of rubber. Third, there is low cost of effective workforce. In terms of Rubber, it's started with the fresh natural rubber from the rubber trees; after that it will be in the converting process into the rubber smoked sheets, rubber boxes, stick rubber, etc. Before it is sent to the company, factory or for export, it is transformed into a kind of products such as gloves, tires for motorcars, elastic products, etc. In the predicted GDP of Thai in 2012 and 2013, rubber accounts for 3.5% and 3.9% respectively.

Nowadays Thai natural rubbers have become valuable in the global market. The main destinations of exporting Thai natural rubbers are China, Malaysia, Japan, South Korea, the United States of America and the European countries. In 2013, the rubber situation in Thai is predicted to remain fairly stable even though it faces the global economic slowdown. In addition, according to the Euro zone debt crisis, the IMF has predicted the situation of new market countries such as China, Brazil and India. It can be seen that the major effect that causes the GDP rate to rise less than before is the finance crisis in U.S.A, where the Supply chain of rubber consists of the upstream, midstream, and downstream.

The agriculturists of rubber plant a rubber tree and take care of them for 7 to 8 years before they can get fresh rubber or liquid rubber. Some agriculturists may sell the fresh rubber to middlemen and some may convert the fresh rubber into rubber sheets or rubber scraps. Then the products pass through the structure of middleman in the rubber market. After that they send rubber to the midstream for converting the raw material of latex into rubber smoked sheets, stick Thai rubber, and concentrated latex. Most of the products and some raw material got from this process will be exported to other countries and some of them will be used for local consumption. Some of them may go to the last step that is called downstream, this step will continue to convert rubber products into other products and also export the products in this process.



Figure 3: Supply Chain of Rubber Industry (Source: http://bal.buu.ac.th/vcml2009/paper/S101.pdf)

3.2 Textile Industry

The textile industry is primarily involved in the production of yarn, and cloth and the subsequent design or manufacture of clothing and their distribution. The raw material may be natural or synthetic using products of the chemical industry.

Because it is a large industry, which includes many industries. Textile industry normally exports the amount of textile fibers (60%) more than clothes (40%) to other countries. The main exported products of Textile Industry in Thailand are thread and cloth. This industry plays an important role in importing continuously the currency in Thai. Thailand is the second biggest exporter of textile products in Asian next to Indonesia. Compared to the whole world textile industry, Thailand has a large number of exports, which makes it rank 12<sup>th</sup> in the world.

At present, the number of entrepreneurs in Textile Industry is around 163,827 companies from the whole country. Because textile & cloth industries include many industries, the number of hired workers is increased to 1,023,000 workers or 12 percent from overall workers in manufacturing section. There are 810,850 workers or 79 percent only in cloth industry. We can see that textile and cloth industries have to hire a large number of workers to work but this will be the major problem nowadays because the increasing wage rate that forces the owners to reduce their workers; thus, the number of hired employees tends to decrease by 1.7 percent per year

Textile industry consists of step of industry. The first step involved fiber industry (Upstream) that is divided into two parts. The first part is synthetic fibers and the second is natural fibers. The next step is midstream, which includes many industries. The first is spinning industry; it is the industry is using the main raw materials from Thailand. But the other raw materials are imported from other countries. The next step is weaving, knitting industry, dyeing, printing, and making products readymade products. The last step (Downstream) is about finished product or clothing industry delivered to consumers or the clothes manufacturers both in domestic country and foreign countries as shown in the figure below.



(Source: www.nesdb.go.th)

### 3.3 Furniture and Wood Industry

The manufacture and sales of wood furniture have risen to substitute the old furniture that was damaged from the flood. On the other hand the export of wood furniture has declined because of the bad economy in Europe. The manufacture of wood furniture in 2012 was 9million products, which increased by 2.39% from the year before. The manufacture increased to support the damaged furniture from the flood in 2011. The sales of the furniture in Thailand are calculated of 4.58million pieces, which increased by 1.10% from the year before. The annual sales of the exported furniture were 2,982.98 million dollars, which decreased by 1.57% from the year before. The effect came from the bad economy in Europe and United States.

There is a lot of competition at present. The sawmill industry has goals in joining AEC. First, Thailand is in the center of trading logs and furniture in Northeast area. Thailand also has higher opportunity of expanding the facilities and is moveable to CLMV (Laos, Cambodia, Burma, and Vietnam) to use the benefit of Least Developed Countries (minimum Wages). There is also another way of developing the industry by using "Industrial Cluster". It will happen when the supply chains are cooperating into a cluster so they are able to compete with other countries.

Thailand is held to be the top of the world is the growth of rubber tree. This increases the number of rubber tree in Thailand. The Para wood industry cycle is divided into 3 parts. First, upstream begins by creating rubber gardens, choosing the seeds to find the best skin of the woods, which from selling rubbers, cut down the trees into logs and transporting the log to sawmill. Second, midstream (Secondary Industry) cutting is composed of sawmills, wood drying factories, wood seasoning and chemical treatment plants, and artificial wood manufacturing factories. It starts from a log in to a lumber; the size is depending on the order and change the wood into something

else such as particleboard and fiberboard. Third, downstream (tertiary Industry) is composed of furniture factories and parts productions. The downstream will use the Para-wood, plywood and fiberboard to process it into furniture, equipment, etc. to export it.

The export of this industry can be divided into 3 parts. The first group consists of wooden furniture and other furnishings parts. The main export markets are Japan, United States, United Kingdom and Australia. The second Wood products group includes construction wood, wooden photo frames and wooden figurines. The major export markets are the United States, Japan, Switzerland and the United Kingdom. Exports of wood products have the total value of 8% of wood products and furniture. The last parts is consists of woods and wood board such as veneer wood, plywood, fiberboard and wood products. The main export markets are China, Japan, Malaysia and Vietnam. The export of wood board products has the value of 60 percent of all the wood products and furniture. The highest export proportion is lumber. The value of export lumber products in year 2012 is \$1,794.63 million dollar, which increased by 0.10 percent from the year before.



Figure5: Supply Chain of Furniture Industry (Source: http://furniturekingdom.blogspot.com/2009/05/chain.html)

## 4. Case studies and cross case analysis

In this section, we will explain the analysis of comparing and contrasting companies in the same industry that we interviewed in form of cross case analysis by using data from supply chain position, size of firm, type of ownership, etc.

### 4.1 Case studies in Rubber Industry

The result from interviews in table 2 will show you about all of the factors related to innovation. Firstly as for the size of the company, the small size company is not affected by the new innovation because it is difficult to evolve and research the new products at the small place. And there is no collaboration such as RUBBER FARMER. In the case of the medium size company, it can be affected by the new innovation but it's not the main factor such as HIHERO CO., LTD. In the case of YOKOHAMA MANUFACTORING THAILAND it has collaboration with Japan, getting all the knowledge form Japan. Among all of the company sizes the innovations will happen in the large size company, because they have more chances than other size companies and they also have transfer of knowledge with each other such as THAIHUA RUBBER CO., LTD.

Second, as for employees, small and medium numbers of employees can affect the chance to have a new innovation; their chance is less than the large number of employees. In large amount of employee can have more chance of new innovations and collaboration such as THAIHUA RUBBER., LTD and YOKOHAMA MANUFACTORING THAILAND; however it also depends on number of the specialists. If the company has a large number of specialists, they have more chance to create new innovation by evolution, and research of new information and transfer of knowledge from the specialists of the company. Third, capital consists of capital investment and objects; the companies that have less capital investment can have low innovation because they have little chance to use the new machinery for researching new things and also have no chance to connect with another country, such as RUBBER FARMER. In the case of medium capital investment, they will have more chance than those with less capital investment because the companies can invest in new machinery, evolution and research and also get in touch with another country to collaborate together such as YOKOHAMA MANUFACTORING THAILAND. In terms of large amount of capital investment, it has more creating innovation because in addition to having an effective research and also expanding the business into new branches that can help create innovation and collaboration such as THAIHUA RUBBER CO., LTD.

Fourth is supply chain position, upstream process doesn't need any innovation and collaboration because this process is about producing rubber trees and keeping the natural fresh rubber, in which the finished product and the process in this process might be the same for example, RUBBER FAMER. In terms of midstream process, it has little chance to create innovation because they have the converting process in standard and rubber cannot be converted into too many kinds of products and need not use the collaboration to research the new products by connecting with another country to learn and improve it such as THAI RUBBER LATEX CORPORATION and THAI HUA RUBBER CO., LTD. In downstream, companies have more chance of product innovation, market innovation and process innovation and collaboration in term of knowledge. For example YOKOHAMA MANUFACTORING THAILAND by Japan always checks and controls the standard of products.

Fifth, creating innovation by entrepreneur depends on how to monitor the company, relationship with employees and how to transfer knowledge to others. In the case of low skill of entrepreneur, the company requires creating innovation, and also creating collaboration by the high skill of the manager or owner who have more chance to contact other people that might use the national language such as THAIHUA RUBBER CO., LTD and YOKOHAMA MANUFACTORING THAILAND.

Lastly the important factor that absolutely affects creating innovation is firm type, the domestic Thailand 100% have lower chance of creating innovation than Joint venture with others because they can transfer knowledge to each other. HIHERO CO., LTD is the example of domestic Thailand 100% that have little chance to collaborate with others. THAIHUA RUBBER CO., LTD is the example of joint venture and they also have the collaboration with joint countries and they always transfer the knowledge about how to build standard rubber.

#### Table 2: Characteristics of interviewed firms in rubber industry

#### 4.2 Case studies in Textile Industry

Table 3, consists of factors that create innovation. First, company size directly impacts the happening of innovation because a small company can only innovate just a few points concentrating on the organizational process and the collaboration in transferring knowledge from worker to worker and from consumer to company. For a medium size company we clearly see that it has more innovated than a small company by developing their technology to be high and create product innovation that is specified by customer pressure. A large company has the most innovation because they have to set highest standards to follow consumers' needs. Obviously, large companies are more successful than small companies because size is the thing that can indicate their abilities and readiness for doing business. A large company such as LUCKYTEX is a good example that can represent how to manage and develop the company because they are punctilious to set the plan for managing all systems and also set the criterion in every step of process to get high standards by collaborating with both suppliers and customers. In contrast, a small company such as SAWANGRUNGRUENG uses different ways to arrange their work because it mainly focuses on domestic consumers not foreign consumers like other large companies so, it will not know other strategies that can enable it to adapt with their companies. Both consumer and supplier for meeting the standards take collaboration. We can observe that a small company will take less collaboration than a large company because a large company has prominent structure which makes it easy to coordinate with others.

Second, the number of employees is divided into three groups. Firstly, small group can create little innovation. Medium group has enough power to create innovation but not much. Large group is the most effective to create innovation because of their skills that can brainstorm for developing. The number of employees can also affect collaboration: a small company can collaborate more than a large company because it is easy to approach a small group of people.

Third, amount of capital investment can indicate how much ability they have to evolve their companies. The more money, the more innovation they have. Supply chain position also affects innovation, especially in midstream because it has to interact with both the supplier and the consumer, so collaboration is mostly done by giving technique and knowledge for performing the tasks. Comparing upstream process and midstream process, we see that a company in upstream

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Company	RUBBER FARMER	HIHERO CO.,LTD	YOKOHAMA MANUFACTURING THAILAND	THAI RUBBER LATEX CORPORATION	THAI HUA RUBBER CO.,LTD
Size	Small	Medium	Medium	Large	Large
Employee	15	150-200	400	1000	4800-5500
Capital investment (Baht)	250,000	232,000,000	Conceal	1,000,000,000	820,000,000
Supply chain position	Upstream	Down stream	Down stream	Midstream	Midstream
Entrepreneur	-Leadership -Knowledge -Stay organized -Not risk taker -Creative Thinking	- Know target customers - Knowledge - Leadership - Teamwork abilities	- Broad knowledge base in critical areas - know customers - Plan everything - Good Network of Professionals	<ul> <li>Plan everything</li> <li>Good Network of</li> <li>Professionals</li> <li>-Leadership</li> <li>Know customers</li> <li>Appreciate your success</li> <li>by giving back</li> </ul>	-Leadership - Good Network of Professionals - Teamwork abilities -Customer is the member of family - Spirited to decide in investment
Firm type	Domestic Thailand 100%	Domestic Thailand 100%	MNCS By Japan and Thailand	- Joint venture -Corporation branch at Myanmar	-Joint venture -Corporation in each department with China, Laos, Myanmar and Cambodia
Collaboration	None	-Transfer knowledge about how to control the machinery and chemical materials	- From parent company to related company -Transfer knowledge about how to control the machinery and production line	None	-Form Thailand to corporation country -Transfer knowledge about how to grow up the rubber trees for standard
Source of Innovation	None	Customer pressure	Engineer of Headquarter at Japan	R&D department in firm	President and vice president (Factory), Customer pressure
Type of Innovation	None	Product innovation	Product innovation and find new knowledge	Improvement on technology development and R&D system	Technology process and organization process innovation

process such as Teijin Polyester has less innovation than a company in midstream process such as LUCKYTEX, PP.TEXTILE, and RH.TEXTILE, because companies in the middle chain interact with both consumers and suppliers. For instance, customers transfer knowledge to LUCKYTEX to inform the company about how to follow their demand. After that LUCKYTEX has to train their supplier to make higher quality materials to meet the set standards. On the contrary, Teijin Polyester has to coordinate with only one side, which comes from a midstream company, hence their innovations are not various and mainly focus on how to keep the quality of materials.

Next, different entrepreneur characteristics can directly show different ways to create innovation, depending on the level of education and experience. Most entrepreneurs encourage the collaboration for developing their business by accessing to the source of knowledge. Firm type is classified into two parts. Firstly, domestic business innovate their products for responding to their customers only such. Joint Venture business will try to develop all systems to meet the standard quality by focusing on getting new target market. High standard companies that have to follow customer pressure normally take collaboration because they have to join with others to update what they should do. From observing, joint venture company, parent company or specialists of headquarters country create innovation. But for domestic company, owners create innovation because they have no specialists, so they are the one who plan, manage, and monitor their working system.

Table 3: Characteristics of interviewed firms in textile industry

#### 4.3 Case studies in Furniture and Wood Industry

There are many characteristics of the furniture industry in table 4. First is the size of the company, which affects the customer's confidence in the liability or quality of the products. The different size of the firm can determine innovation. Large companies have higher probability on innovation than medium and small size firms because they have a high in customer pressure than the others. For example, SEP WORLDWIDE has a net income higher than THANAWAT COMPANY because different size for upstream. In midstream, P.KIJSIRI is also having higher income than TEERAWAT because of the size as well. In the part of collaboration the size of the firms are also initiations to support the firms. To get perfect products, they need to find a good midstream factory. For midstream, to process the better outcome, they need to have a good collaboration with supplier to reduce the complication of process. For example, P.KIJSIRI has a better product quality. Another example SEP WORLDWIDE, who has bigger size Than THANAWAT COMPANY, would probably be attracted more merchandisers to sell the logs to them than others. This linkage is, therefore, the essential process for the midstream enhancing the collaboration between supply chain members.

The second is employee, which is the major factor in finishing the goods on time. In the upstream, the big firms need better labors skills. The larger size of labors has a higher innovation rate but it harder to control and Small size of labors have low innovation rate. Therefore the medium labor size is the right amount to support innovation for example P.KIJSIRI will have a better innovation chance than TEERAWAT because they have more employees that have much different knowledge. This can also be seen in upstream, for example SEP WORLDWIDE has more

Company	SAWANG RUNGRUENG TEXTILE CO., LTD.	RH TEXTILE CO., LTD.	PP. Textile CO.,LTD	Teijin Polyester CO.,LTD	Luckytex Public CO.,LTD
Size	Small	Medium	Medium	Large	Large
Employee	30	120	370	500	2562
Capital investment (Baht)	4,000,000	10,000,000	50,000,000	548,000,000 Japan 67%, Thailand 33%	528,400,000
Supply chain position	Upstream	Down stream	Down stream	Upstream	Midstream
Entrepreneur	-Leadership -Knowledge -Not risk taker	- Leadership - Positive Outlook	<ul> <li>Leadership</li> <li>Positive Outlook</li> <li>Follow-up</li> <li>constantly</li> </ul>	- Understand the value of a strong peer network - Highly self-motivated	- Creative - Innovative spirit - Serial innovators - Strong leadership qualities
Firm type	Domestic Thailand 100%	Domestic Thailand 100%	Domestic Thailand 100%	MNCS By Japan and Thailand	MNCS By Japan and Thailand
Collaboration	-Thai to Myanmar labor -Consumer to company	None	China to Thailand 558	-From parent company to related company	<ul> <li>From parent company to related company</li> <li>Transfer knowledge about how to keep the material quality to supplier</li> </ul>
Source of Innovation	Owner	Competition	Customer pressure	Headquarter at Japan	Headquarter at Japan

employees with various skills than THANAWAT COMPANY. The employee factor is also significant for collaboration. If the employees are not eager to accept new knowledge, there will be no collaboration between streams. The smaller number of employees will actually collaborate with other stream easier than the high number of employees because it is easier to communicate and understand. On the other hand if there is a high number of an employee, it will cause miss communication. The big company can have complication on collaboration such as P.KIJSIRI and SEP WORLDWIDE, which have problems in communication among their workers, unlike THANAWAT COMPANY and TEERAWAT in upstream and midstream.

The third is capital, which affects the capability of investment. The companies that have high capital are likely to have higher chance of innovation. In the upstream and midstream, capital is needed; large firms need high capital to buy machines that are capable of fulfilling their productivity goal such as P.KIJSIRI and SEP WORLDWIDE, and these companies from midstream and upstream need high outcomes which require better machines to do so, unlike TEERAWAT and THANAWAT which works fine for their size of the company. In downstream, the capital is meant to be invested in the building and the design. For the collaboration between streams, capital is essential. If the company has high capital, companies of the other streams will more likely support it better. For example, P.KIJSIRI has higher capital than TEERAWAT; it has better collaboration with other streams. That is true to downstream as well; for example, SEP WORLDWIDE is larger than THANWAT COMPANY and because it has higher capital, SEP WORLDWIDE has a better collaboration because of more customers.

The fourth is characteristics of entrepreneur: the will of investor to take a risk, leadership, management and planning skills. The entrepreneur makes the decision on collaboration with others such as receiving new knowledge from Laos or transferring their knowledge to the new generation CEO. In the upstream, it is more possible to contact Laos, China, Malaysia, etc., to negotiate on the log or lumber supplies because the quality is better than Thailand and it is cheaper, which will have opportunity to bring in innovation from foreign countries for example SEP WORLDWIDE, which imports products from Laos has bargaining by selling products to China, which THANAWAT COMPANY cannot do. In the midstream, the innovation is needed even in small firms because the designs of the products are important, unlike the downstream, which does not need high innovation, for example P.KIJSIRI and TEERAWAT need innovation to satisfy the customers. There are two types of firm: Thailand Domestic and Joint Venture. The Joint Venture has more opportunity of innovation and collaboration. The reason is that the Joint Venture is combining the investor from different areas and countries. For example, SEP WORLDWIDE has three investors from different areas of Thailand, unlike THANAWAT that has only one investor. Since they are from different areas, which mean they have various knowledge and ideas from different countries and streams, unlike Thailand Domestic. There are three streams in this industry. The upstream's duty is to cut down the logs into lumbers and store them in warehouses and export them to midstream. The duty of midstream is to process lumber into finished products and the downstream does the marketing and sells the products.

Company	THANAWAT COMPANY	TEERAWAT TIMBER CO.,LTD	SEP WORLDWIDE	SUDSAWAD THAI PLYWOOD CO.,LTD	P.KIJSIRI FURNISHING
Size	Small	Small	Medium	Medium	Medium
Employee	6	40	200	350	190
Capital investment (Baht)	10,000	11,600,000	70,000,000	29,000,000	5,000,000
Supply chain position	Upstream	Midstream	Upstream	Upstream	Midstream
Entrepreneur	-Skill Knowledge -Not risk taker - Less level the playing field with technology - Not Risk Takers	<ul> <li>Willingness to fail</li> <li>Strong negotiating skills and ability to develop win/win results</li> </ul>	- Proactive and take initiative - Leadership - Works Hard - Has Business Experience	-Strong negotiating skills and ability to develop win/win results - Teamwork abilities - Strong leadership qualities	<ul> <li>Leadership, planning, and management skills</li> <li>Willing to exploit new opportunities</li> <li>Prefer the excitement of risk</li> </ul>
Firm type	Domestic Thailand 100%	Domestic Thailand 100%	Domestic Thailand 100%	Domestic Thailand 100%	Domestic Thailand 100%

Table 4: Characteristics of interviewed firms in furniture and wood industry

Collaboration	None	Thai to Myanmar labor, company to supplier and consumer to company	None	China supplier to Thailand company and Headquarter to company	Customer to company
Source of Innovation	None	Owner	Owner	Headquarter	Customer pressure
Type of Innovation	None	Product innovation	Technology process innovation	Product innovation and organizational process innovation	Product innovation

#### **5. Cross Industry Analysis**

We have learned many things from interviewing all these three industries that we have mentioned before. First, company size is not the factor of creating innovation for rubber industry and furniture industry because their processes are limited and difficult to develop. On the contrary, company size is one of the factors of innovation in textile industry because working processes can be modified to get the new form of materials for meeting customers' needs.

Second, the number of employees can help to achieve the tasks and plans for all three industries. The rubber industry must have skills and techniques to perform the work especially for companies in upstream process. For workers in textile and furniture industry there is has no requirement of skills because the processes involve machines that everyone can control.

Third, more capital investment in all these three industries help create innovation because to create innovation they must prepare funding for getting new things such as machines or hiring specialists. However, upstream process of rubber industry does not depend on capital investment as much as others because the processes are strict, so funding may not affect innovating.

Fourth, supply chain position can affect innovation directly. For example, rubber (RUBBER FARMER) and furniture (THANAWAT) in upstream process have no innovation because the material is of stable quality and it is difficult to change the form of performing. In contrast, upstream process of textile industry such as TEIJIN POLYESTER has innovation because the working processes are very complicated which can be adjusted to meet the requirements as much as they want. For midstream, not only rubber industry but also textile and furniture industry have innovation because they have to coordinate and adapt the process by following the limitations of downstream companies. In downstream position, rubber and furniture industry also have innovation because they are in the last step that is ready to deliver the products to consumers, hence they have to ensure that they maintain the product quality. Therefore, position in supply chain can also create collaboration especially in downstream process. For example, YOKOHAMA has to transfer their knowledge to supplier for getting the specific quality.

Fifth, entrepreneur characteristics in each industry are differed from each other depending on what they know, their experience, knowledge, and what they are focusing on now. Next, firm type is related to the different innovation of companies. Domestic owners from these three industries are the ones who have less abilities and ambition to evolve their companies than foreign owners who are owners of joint venture businesses because they only compare theirs with the competitors within their country and focus on domestic consumers only. But for joint venture business, they receive new knowledge from their parent companies which always try to achieve new challenges which come from everywhere because they not only focus on their customers but also always find new target markets for expanding their businesses worldwide. Therefore, we can infer that domestic businesses get lower innovation than the other. Then, collaboration in small rubber and furniture industry does not take place in upstream process but in textile industry collaboration takes place because they can change the form of materials to respond to customers' needs.

#### 6. Conclusion and further works

In this paper, we study three industries that are rubber industry, textile industry, and furniture and wood industry. The firm characteristics such as firm type, size, forms of collaboration, the major factors affecting SCC, and source of innovation are factors that have effect on creating innovation and forming collaboration. For the further study, an empirical survey will be conducted

to study innovation and local technological capacity in Thai natural resource-based supply chains in other industries such as automotive industry and food industry.

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