CLUSTER MAPPING FOR ECONOMIC DEVELOPMENT IN THAILAND

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Abstract- This study investigates cluster mapping in Thailand. Cluster is the major driving force for economic development. A cluster is a group of related firms, public sector entities, and other related institutions with the objective of improving the competitiveness of a group in a specific geographic region. For this study, major clusters were identified in each region. The data were collected from secondary sources such as government database, statistical data, and secondary document. The cluster map can be used to guide business investment and provide the direction for government policy.

I. INTRODUCTION

A cluster is geographical concentrations of interconnected firms, specialized suppliers, service providers, companies in related industries, and associated institutions including universities, standard agencies, trade associations in particular fields that cooperate and compete at the same time. A cluster enables productivity and increase efficiency because firms and institutions in the cluster can share resources and collaborate to create innovation. In addition, the cluster enables location attraction, export promotion, market information, workforce training, investment, and standard settings.

Thai's government has realized the importance of cluster policy. The cabinet and the Thailand Board of Investment, therefore, proposed the Cluster Policy which came into effect on September 16, 2015. Initially, the government has targeted to develop 2 types of clusters including super cluster and traditional cluster. Super Clusters including clusters using advanced technology and hi-tech industries, of particular importance for international competitiveness of the economy. They are including Automotive and Parts Cluster, Electrical Appliances, Electronics and Telecommunication Equipment Cluster, Eco-friendly Petrochemicals and Chemicals, Digital-based Cluster, Aerospace Industrial Cluster, Food Innopolis, Medical Hub, and Automation and Robotics Industrial Cluster. Other clusters include traditional clusters such as Food &Agro-processing Cluster, and Textile and Garment Cluster[1]. The policy provides the benefits for both tax and non-tax related, which are show in the table 1. Therefore, If the clusters are well established and aligned with the country's policy, theses mentioned clusters are expected to bring economics benefits as well as increase the country competitive advantage[1].

Incentives	Super Cluster	Other Clusters
Tax	**BOI** - 8-year corporate income tax exemption and an additional 5-year 50% reduction - Import duty exemption on machinery **Ministry of Finance** (Details are to be announced) - For Future industries with significant importance, the Ministry of Finance will consider granting 10-15 years corporate income tax exemption - Personal income tax exemption for international specialists to work in the specified area, both Thai and foreign	- 3– 8 year corporate income tax exemption and an additional 5-year 50% reduction - Import duty exemption on machinery
Non-Tax	- Consideration of granting Permanent Residence to the leading specialist - Permission for foreigners to own land to implement the promoted activities	Same as Super Cluster

Source: BOI

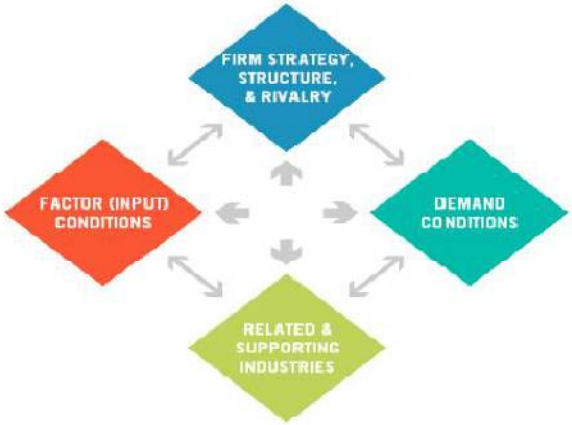
BOIZoning

The cluster policyisdividedintothreezonesbasedoneconomicfactors,which earningsandprimaryfacilitiesare the main criteria to define the zone for each province [1]. Most developed provinces with well economic performance such as Bangkok the capital, and some provinces nearby are categorized as zone 1, while less

developed areas are categorized as zone 2 and zone 3 respectively. BOI has strong intention to encourage investors to focus on less developed areas such as zone 3 provinces(Northeast Provinces). The government hopes the investment can provide competitiveness in the less developed area.

Cluster Policy

A cluster is concentration of firms and related institutions that operate within the same geographic areas. The objective of the cluster is to promote support and cooperation among firms and institutions[2-4]. In addition, cluster can attract investment and create socioeconomic development to the region. According to Michael E .Porter, Clusters are geographic concentrations of interconnected companies and institutions in a particular field. (Porter, 1998). They Include all aspects of the field from upstream to downstream, for example, from governmental institutions such as universities, extended to specialized suppliers or service providers, and also down toward product manufactures or even consumers .These components and participants of clusters although sometime compete with each other but they do cooperate with the common ultimate goal to Increase their competitive advantage .They share a number of common needs, opportunities, and also encounter with many constraints and obstacles to productivity .By gathering, sharing Information and increasing in competition, participants in each cluster are more likely to be able to Increase their productivity which is the most key factor of success for their business .Besides, higher competition also enhance capacity for Innovation as well as for production growth significantly .New business formation which supports Innovation and expands cluster can also be simulated while the competition has been taking place .As a result, these phenomena can be major economic benefits for both clusters level and also national level [2]. Economics benefits of clusters can also be explained through each component of Diamond model below.



Source: Porter, M. E. (1998). Clusters and the new economics of competition, Harvard Business Review Boston.

Factor Inputs Include tangible and intangible assets, Information, physical, legal infrastructure and Institutions etc. which are required to Improve efficiency and productivity of particular clusters. However, to be enhanced within the cluster, some infrastructure should be specific and specialized in the geographic area that cluster is located.

Context for Firm Strategy and Rivalry which refers to rules, incentives and norms that shape the type and intensity of local rivalry. If they are well designed to Increase local rivalry, productivity will be Increased. In addition, to move to advanced economy, rivalry among the cluster should be motivated to shift from low wages to value added product which Implies higher efficient manufacturing and service delivery. Furthermore, good Context for Firm Strategy and Rivalry can attract investment to the clusters.

Related and supporting Industriesrefers to the availability of related suppliers and industries. The related suppliers and industries provide spilled over effects to the cluster.Moreover, they allow firms and institutions in the cluster to be connected and collaborated.

Demand Condition refer to the local demand that allow firms to test their products. Sophisticated demand allows firm to be innovative. It also gives pressure to the firms in cluster to create high quality products and services to meet customer demand.

Cluster Mapping

Cluster mapping is about contextualizing a specific cluster of economic activities within the overall economy. An economy-wide outline is developed to indicate relative contributions made by specific core of cluster on various aspects such as employment, innovation, dominance, linkages, etc [2].

The development of cluster mapping as a scientist tool relates to two aspects of cluster behaviours: First, cluster mapping is based on the mapping of the industrial classification code into clusters. Second, these data allow the mapping of clusters across geographies indicating the locations and perimeters of the core of related cluster.

Identifying the components of the cluster involves

1. looking upstream and downstream in the vertical chain of firms and institutions.
2. looking horizontal to identify industries that pass through common channels or that produce complementary products and services. Identified based on the use of similar specialized inputs or technologies or with supply linkage
3. To isolate the institutions that provide it with specialized skills, technology, information, capital, or infrastructure and any collective bodies covering participants
4. To seek out government or other regulatory bodies that significantly influence participants in cluster.

The key advantage of the cluster mapping exercise is its grounding in actual cluster behaviours. Without

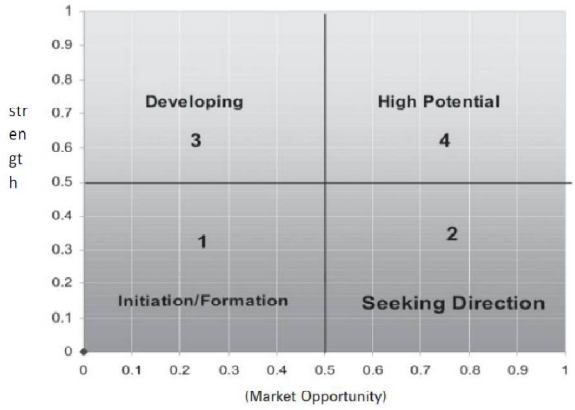
tracking the actual linkages and contributions across and within clusters, the comparisons between industrial sectors or geographic regions are likely to be only arbitrary. The key disadvantages of the cluster mapping exercise, however, are two: First, it is not easy to formulate the exact definition and perimeters of clusters. Second, obtaining data at this level is time consuming, especially in less developed countries.

Cluster Performance

OECD (Organization for Economic Cooperation and Development) Implemented Cluster Scoreboard that measure cluster performance using six Indicators[5].

1. Entrepreneurialism which is measured by share of firms aged below 5 years in a cluster.
2. Employment growth, which is the annual growth rate of employment
3. Turnover growth which is the growth rate of turnover for each firm.
4. Profitability growth which is returns on total assets (ROTA) of each firm.
5. Liquidity ratio growth which represent financial viability of clusters.
6. Solvency ratio growth which is also another indicator for financial viability of clusters.

Besides these six Indicators, some specific Indicators can be used to measure the performance of the cluster. For example, the medical cluster used recovering rate of patents as one of the Indicators[5]. Besides six indicators mentioned earlier, performance of clusters are also assessed based on their strength and market opportunity [6]. Clusters are categorized based on these two factors as shown in X and Y axis in figure below.



Clusters can be categorized in one of the four categories.

1. Initiation/Formation is a group of cluster that is just established. Cluster identity is not clearly defined. There is no specific demand and no product advantage. Price is the important factor for competitiveness.

2. Seeking Direction is a cluster that is just establishedsimilar to the Initiation, but there is a clear market demand. Customer group is clearly specified. However, the cluster still cannot get the access to the market because the products or services do not meet customer demand. There is a lack of quality standard or the use of innovation.

3. Developing Clusters is a well-established cluster. The cluster is already mature. This cluster requires continuous improvement and strategy to develop products and service to meet customer demand. The demand for the product is low.

4. High Potential Clustersis a well-established cluster. The collaboration among firms and institution is high. The products and services successfully answer customer's demand. This cluster can be developed further through the use of innovation and research.

Cluster Mapping of Thai Regions according to location quotients

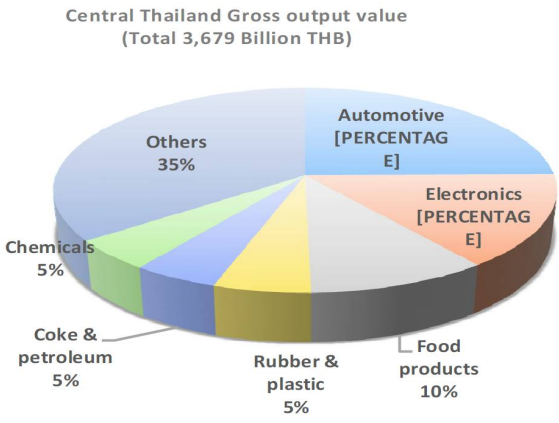
This part investigates clusters based on their locations and the regions, which are divided into four main regions as Central, Southern, Northern and Northeastern Thailand. Each region has its own competitive advantages anddisadvantages. Each region is suitable for different clusters. Three major clusters are studied for each region. These three clusters are selected because they are considered mature and successful cluster in the region.

3.2.1 Central Thailand

Located in the center of the country, central Thailand has been the center for domestic logistics and transportation. Many national academic institutions have been established and attracted people from all over the country to attain their education in Bangkok. Similarly, great numbers of jobs also attract many people to come seek for a better life. Central Thailand is well known for many tourism cities such as Bangkok the capital city, Ayutthaya, an ancient capital, and Pattaya, a tourist destination.

Central region has been the center of technology and Innovation manufacturers which create high value-added products and service.The major clusters in Central Thailand are automotive and electronics.

It can be seen that Automotive and Electronics are the key drivers of the region which acquire about 25% and 15% respectively. The Automotive has been the country successful cluster, while electronics is also considered a potential cluster.



Source: NSO

Automotivecluster

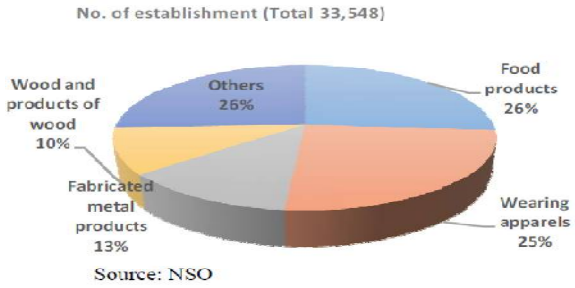
Automotive cluster has been the major sector for the economy of Central region. It contributes 25% of the total output[7].The cluster has many supporting components including local suppliers, academic institutions, associations, and government agencies. The government has successfully attracted foreign investment from global manufacturers such as Toyota, Honda, Nissan, Volvo, Mercedes-Benz, and BMW. The critical factors that attract investors to invest in Thailand are skilled labor at low cost. In addition, Thailand has abundant supply of rubber. However, the minimum wage was increased. Some manufactures are moving their production base to lower cost countries such as Vietnam and Indonesia.

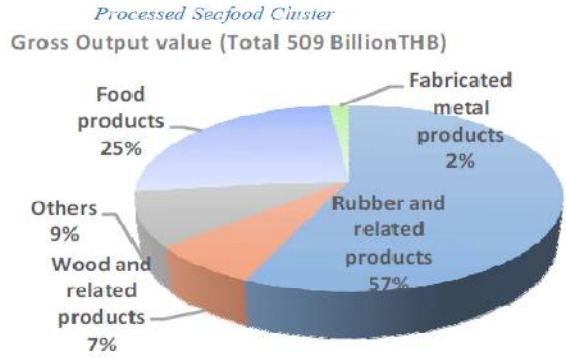
Electronics cluster

Electrical Appliances, Electronic, and Telecommunication Cluster covers seven provinces including Ayutthaya, Pathum Thani, Chonburi, Rayong, Chacheongsao, Prachinburi, and Nakhon Ratchasima. Thailand has been the major destination for electronic and electrical appliances due to skilled labour, good logistic systems, location, and support from the government. In addition, there are many academic institutions providing support for research and training for the cluster. The major product for this cluster includes hard disk drive, electronic parts, telecommncation equipment, and embeded systems. There are • Numerous private-public partnerships such as the EEI and NECTEC that promote new technologies, product development, and support for electrical and electronics firms, with the support or coordination of the Thai government and other stakeholders.Furthermore, to ensure sustainable growth of the industry, BOI grants a wide range of incentives to investors .Tax-based benefits include exemption or reduction of import duties on machinery and raw materials, and corporate income tax exemption for up to eight years .The non-tax incentives are also permission to bring in foreign workers, own land and remit foreign currency abroad [1].

Southern Thailand

Two major clusters of Southern Thailandare Processed seafood and rubber clusters. Stretching from just south of Bangkok down to the Malaysia border, Southern Thailand, with its world class beaches and islands, plays host to some of the Kingdom's biggest tourism attraction. Besides tourism Industry, agricultural Industry also play the critical role in southern economy.Rubber and related product is accounted about 57% of Southern Thailand GDP. In general, Southern Thailand Gross product value is accounted for 8.6% of the country GDP [1, 7] Southern geography, climate condition, natural as well as human resource also bring benefits for variety of manufacturing Industries. Rubber and food products are two of the major drivers as seen by the number of establishment and gross product value below.

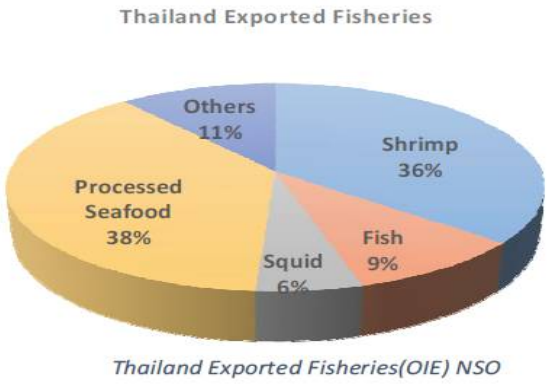




Source: NSO

Processed Seafood Cluster

An abundance of natural resources, combined with human resources and food processing technology, Thailand is often known as"Kitchen of the world". As the highest export gross value, fisheries product account for more than 25% of Thailand's exported food [1]. Processed seafood such as canned seafood plays an important role in the export market due to its scarcity in other countries.Rich natural resource for processed seafood product can be found in Southern Thailand, it was estimated that 62% of aquatic animal of the country can be found in the southern part of Thailand. Southern fishermen are regarded to be high skill. Moreover, there is also a number of private manufacture who has been working with local fisherman to obtain fishery products to be utilized for furthered food processing in their factories. These are some of the factors that have been enhanced processed seafood cluster in the South of Thailand. Processed seafood cluster mapping is illustrated in Figure 15 (OIE, 2014).



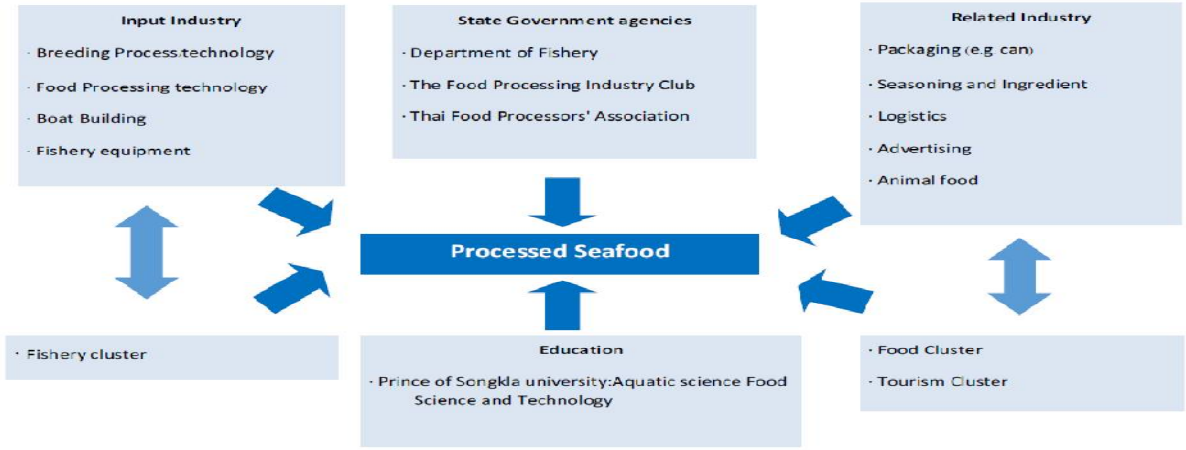
Processed Seafood has been one of the strongest clusters of the country, however there have also been a number of issues and difficulties. Refugees and Illegal labors is one of the major issues that has degraded seafood Industry. Seafood from Thailand was banned over slave labor by EU countries[8].

Rubber Cluster

As the world number one producer and exporter of natural rubber, Thailand produced around 4.5million tons and exported about 3.7 million tons, which accounted for 36% of global natural rubber production in 2015.Referring figure 11 & 12, even though the number of rubber manufacturer is not as many as other industries, it still acquired more than 57% of the region gross output values[9].

Rubber products can be categorized into two products which are primary processed rubber (in the form of liquid rubber and rubber sheet), and finished rubber product such as rubber gloves, tires, condom etc. However primary rubber which is the main portion of Thailand export market has relatively low price and value added compared to finished rubber goods, 10-15 times less in value .lack of knowledge and advanced technology restricted local manufacturers to turn their rubber into more valuable product. Moreover, although a number of research on rubber application have been carried out in order to create high value for rubber, only a few of them are encouraged and applied to the Industry.

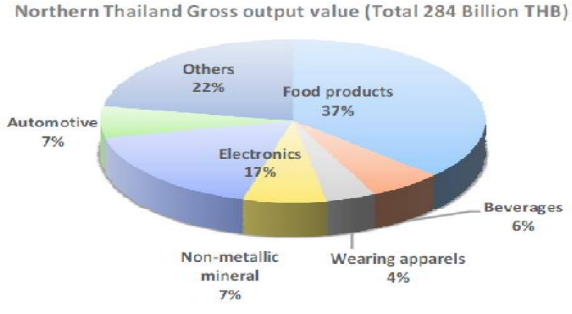
Aligned with Thailand 4.0 policy, finished rubber products have been encouraged in both local and national level, one of the example is Natural Rubber Production, Technology and Management and the Polymer Science Programs offered by Prince of Songkla University to provide knowledge from upstream to downstream of the Industry. A number of private multinational rubber-related companies such as Bridgestone, Michelin also commit to support Industry such as utilizing local supply, and provide training for labors[9].



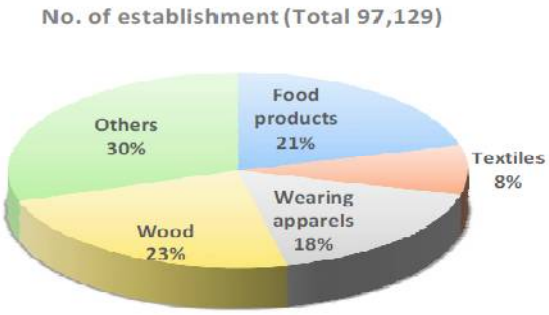
Furthermore, The Ministry of Industry has assigned the Industrial Estate Authority of Thailand (IEAT) to establish a Rubber City in the southern border province of Songkhla, to serve as a hub for rubber products. Thailand's Board of Investment(BOI) offers various tax and non-tax incentives to businesses in the rubber industry.

Northern Thailand

Two major clusters of Northern Thailand are Food &Agro-processing and wood cluster. These two clusters are the driving economic force in Northern region.



Source: NSO



Food cluster is contributed to 37% of northern economy, where the largest number of business establishment is Wood cluster duet to the availability of natural resource.

Food &Agro-processing cluster

Manufacture of food product was the highest value of gross output manufacture industry(104 Billions THB in 2012). Thailand BOI cluster policy targeted Food &agro-process industry because of the availability of raw materials that are available in northern areaincluidng: vegetables, fruits and herbal products in Chiangmai, Chiangrai, Lampang and Lamphun; Rice and grain milling in KamphaengPhet,

Phetchabun, Sukhothai, Phitsanulok and Nakhonsawan[1].

To strengthen industrial value chain leading to creation of future industry base and enhancing investment competencies to attract value added investment, Thailand Board of Investment grants the benefits for 3-8 year corporate income tax exemption and additional 5-year 50% reduction, import duty exemption on machinery, consideration of granting Permanent Residence to the leading specialist, and permission for foreigners to own land to implement above activities[1].

Wood cluster

Northern Thailand is a region of green mountains, misty jungles, fertile valleys, spectacular ruins, colorful hill tribes, and temperatures that are cooler than the rest of country. Natural features made possible several different types of agriculture, including wet-rice farming in the valleys and shifting cultivation in the uplands. Forests is full of economically useful hardwoods.

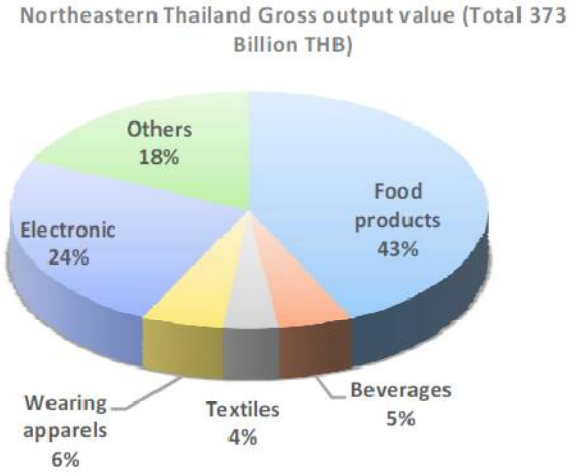
Manufacture of Wood and of products of wood and cork (except furniture) contribute to the largest number of establishments in Chiangmai, Nan and Phrae(22,620 in 2012) but generated value of gross output only 5 billion baht. The main part of wood product was manufacture of straw and plaiting products (17,977 establishments) that value1 billion baht[7]. With the highest number of establishments in northern region, government agency was trying to promote more ways to add value to these products.

Northeastern Thailand

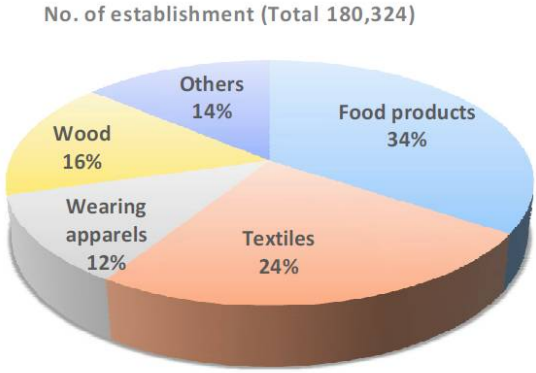
The 20 provinces of Northeastern Thailand, a region known as "Isan", accounts for one-third of Thailand's population and territory, but considered as the poorest region. It generates only 10% of GDP and the per capita income is one-third the national average[10].



This section studies three major clusters of Northeastern Thailand, which are processed Food Products, Textiles and Electronic products. The figure shows the region gross value output and number of establishment by sector[7]



: Northeastern Thailand Gross Output(NSO, 2012)



Northeastern Thailand No.of establishment(NSO, 2012)

It can be seen from above that food Industry is a key driver of the region with both highest gross product and number of business establishment, while textile is the second largest based on a number ofbusiness establishment but it is not listed in one of the high gross output Industry due to its drawback of low value-added products. Beside Central Thailand, a number of world class electronics companies have also been establishing their production sites In Northeastern region especially in "Nakorn Ratchasima" [7]. This mainly due to the fact that Industry areas in this region have relatively lower land cost compared to central Thailand, and many Investors have moved to this location to avoid the risk of great flood as once destroyed many factories in central region in 2012.

Food Cluster

The food industry in Thailand has grown rapidly over the years owing to an increasing demand in consumer market, both domestically and internationally. In order to meet an escalating trade in processed food products, the Thai Government has set to transform Thailand into the "Kitchen of the World" by being the Asia's largest food trade and distribution center. There has also been a greater emphasis on the quality, hygiene, sanitation, food safety, wholesomeness,

lowered production, value-addition and adherence to environmental regulations in the Kingdom, in response to international competition and demand. Although most processed food products are for the international market, the domestic consumption of processed food continues to grow due to changes in lifestyles that have brought about increased demand for convenient food options. Those potentials have made Thailand an attractive destination for international investors[1].

The value of agricultural exports is increasing every year and still a major source of export earnings. Manufacture of Food products industry has the highest value of gross outputs 43% with 34% of establishmentsin Northeastern Region.An abundance of natural resources combined with significant investments in technology, food safety R&D and adhering to international quality standards have helped to dub Thailand as the "Kitchen of the World."Food cluster competitiveness in Northeastern area can be contributed from the availability of natural resources and demand condition from local market. The governement also provides support for subsidiary as well as research and development. Thailand's rice output tends to greatly exceed the demand for domestic consumption. It is because plantation area has been expanded and rice seeds have been continuously developed, while the annual domestic consumption of around 10-12 million metric tons usually increases at a rather low rate. Exports of Thai rice thus have gradually risen – currently, accounting for more than 50% of total outputs.However, the major obstacle is that the cluster still relies on cheap labor and non value added product.

DISCUSSION

It can be seen that different clusters have their own characteristics and individual strength and weakness, however some of them are also related to one another. Strong relationship between automotive and electronics cluster in central region is one of the example. These two clusters have contributed and supported each other for long time. Automotive manufactures always required advanced electronics products to be equipped in their vehicles, therefore research and development have been transferred which results in strong linkage of both Industries.

This connection can be also seen from nearby location where manufactures in these two clusters are located. Moreover, Investment policies and privileges for Investors of these clusters have been aligned so that both of the clusters have been developed in the same direction.



Another pair of related clusters are food (Agro-processing) and tourism clusters in Northern areas. Food &Agro-processed food have been attracting tourists who visits North, while more number of tourist also encourages the growth of Food &Agro-processing cluster.



CONCLUSIONS

This study analyzes cluster policy and cluster mapping in Thailand. Cluster is a group of related companies and institutions located in the same geographic area. Cluster can be used for economic development and business investment. This study analyzes clusters in each region in Thailand. The data were collected from government database, statistical data, and secondary document. The results from this study can be used to guide the cluster development and cluster mapping in developing economies.

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