

# **Analysis of Infrastructure in Neighboring Countries for Thai Outward Investors**

Jittichai RUDJANAKANOKNAD <sup>a</sup>, Natcha LIMSATHAYURAT <sup>b</sup>

<sup>a</sup> *Associate Professor, Transportation Institute, Chulalongkorn University, Bangkok, 10330, Thailand*

<sup>a</sup> *E-mail: Jittichai@hotmail.com*

<sup>b</sup> *Research Assistant, Department of Civil Engineering, Faculty of Engineering, Chulalongkorn University, Bangkok, 10330, Thailand*

<sup>b</sup> *E-mail: bell.natcha@gmail.com*

## **Abstract:**

This research investigates the level of infrastructure readiness in neighboring countries to support Thai investors in three industrial segments, i.e., apparel and textile; electronic parts; and agro-processing industry. The infrastructure in this study includes transportation to market and port, electricity and power, water supply, and telecommunication infrastructure. Ten studied zones are Myawaddy, Yangon and Dawei in Myanmar, Poipet-Sisophon, Kohkong-Sihanouville and Phnom Penh in Cambodia, and Vientiane, Savannakhet, Pakse and Bokeaw in Lao PDR. This research evaluated the quality of existing and being developed infrastructures in those areas through field survey and interview of local investors. After that, investor demands are compiled through in-depth interviews and questionnaires from 51 companies in 3 industrial segments to understand and rank the importance of infrastructure in each industry. Both demand and supply data were compared to show the level of infrastructure readiness in each industry for Thai outward investors. Finally, investment recommendation maps for industries are displayed along with recommendations for Thai government to develop infrastructures according to demand of Thai investors.

*Keywords:* Infrastructure Analysis, Cross-border Transportation, Outward FDI, Industrial Estate

## **1. INTRODUCTION**

Asean Economic Community's main objectives are to bring all member countries into a single market and single production base by several agreements to facilitate the free flows of goods, services, capitals, investments and skilled labors in 2015. This is a major opportunity for Thai investors to expand their production base to other countries especially on Cambodia, Lao PDR, and Myanmar, which are Thailand's neighbors, to utilize plenty of national resources and labors. One of the key successful factors for outward foreign direct investment is the right selection of industry locations. Normally, Thai investors chose their investment locations based on the proximity to raw materials and market, labor supply, local regulations, industry network, and the readiness of infrastructure. For Cambodia, Lao PDR, and Myanmar comparing with Thailand, they are less developed and parts of their infrastructures are not ready for industrial activities. The example of problems are small unpaved highways that cannot be transverse in monsoon season, unreliable electricity and telecommunication network, low quality of water supply and sanitary system. The infrastructure information from

these countries is incomplete (especially on city level) and unsystematically analyzed for specific industries; therefore, Thai investors have missed the important data for their location decision and Thai government cannot plan for supportive policy appropriately.

This research collects infrastructure data in Cambodia, Lao PDR, and Myanmar to analyze their readiness for Thai foreign direct investment and plan for Thai government support. The ten strategic zones in this study are Poipet-Sisophon, Kohkong-Sihanouville and Phnom Penh in Cambodia; Myawaddy, Yangon and Dawei in Myanmar; and Vientiane, Savannakhet, Pakse and Bokeaw in Lao PDR. These zones' internal and connecting transportation infrastructures are collected from field investigation and depth interviews of local businessmen and government. The infrastructures include transportation (highway, railway, airport, and port), electricity and power, water supply and sanitary, and telecommunication. These data are scored based on their quality, sufficiency, and proximity to the zone (for transportation) by using international standards or suitability for investors. They are considered to be infrastructure "supply" of Thai investors if they opt to invest in the zones.

The supply information are used to compare with infrastructure "demand", which collects from questionnaires of Thai businessmen in potential industries, i.e., textile and clothing, electronic parts, and agricultural processing, which are most likely to invest in these zones. The questionnaire comprises the demand of investors in specific kind of infrastructures, government support, countries and zones of interest. Both supply and demand data are compared to use as a guideline for Thai investors if they plan to invest in these zones and for Thai government to prioritize in supportive infrastructure projects and plan for international collaboration that would correspond with Thai investors' demand.

## **2. LITERATURE REVIEW**

### **2.1 Infrastructure**

World Bank (2008) reports the status of Thailand's infrastructure annually. It segregates infrastructure into 4 categories: 1) transportation (highway, railway, airport, and port); 2) electricity and power; 3) water supply, sanitary, and low-income houses; and 4) telecommunication (telephone, internet access). In this study, we use all four categories based on this report excluding low-income housing due to the ease of construction in the new industry areas.

Transportation infrastructure is essential for the movement of raw materials and products. The major characteristics that affect the industry are accessibility, quality, distance to industry location as it directly relates travel time and cost. For analysis, only major transportation infrastructures that connect to main hub or other regions are considered. For example, expressway and main road from industrial areas to a port or an airport are considered but not local roads. There are several agencies that rank quality of transportation infrastructures. For example, United Nations (2001), Federal Railroad Administration (2011), and Wilbur Smith Associates (2010) classify Asian highways, railways, and airports into multiple levels respectively.

Electricity and power have important roles on cost and reliability of production. Lack of reliable power supply is a main obstacle of industry in Myanmar cities. Similarly, water

supply and sanitary system is very crucial for product hygiene of most agricultural processing industries. In addition, telecommunication system (telephone and internet) is necessary for production coordination and business activities.

## 2.2 Industry Requirements and Supply Chain

According to Thailand’s Board of Investment announcement, there are five industries that Thai government advocates domestic investors to establish their business in CLMV countries. They are textile and clothing, agricultural processing, electronic parts, tourist services, and construction services. However, this study excludes the latter two since these service industries are either location dependent or temporary. We then focus on the first three for supply chain analysis.

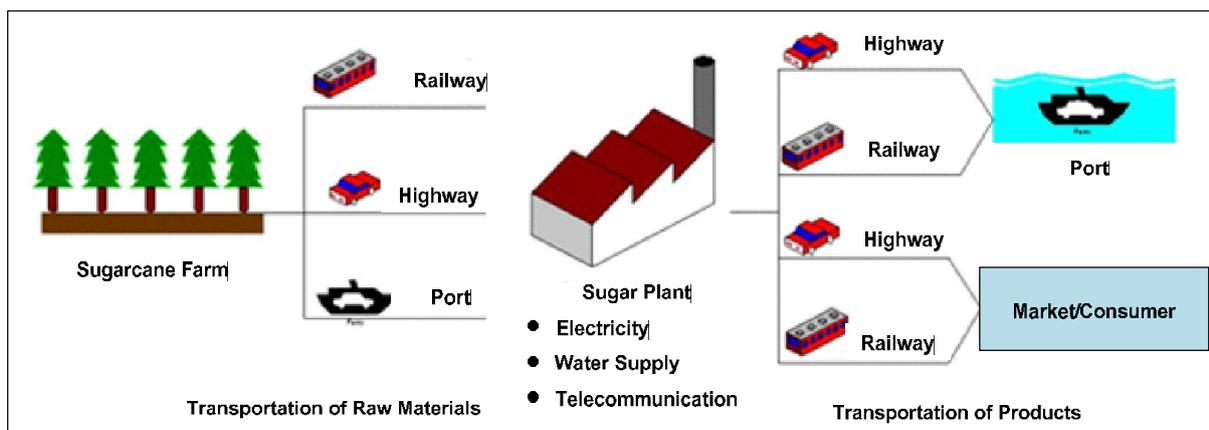


Figure 1. Supply chain and infrastructure requirement for sugar industry

Figure 1 shows supply chain for sugar industry. This is an example of general production and supply chain that usually starts from raw materials transported to a plant. Then, finished products are transported to market or customers. Normally, the infrastructure requirements of each industry are pretty similar. However, each industry could have its own requirements and priority for infrastructure. For example, most textile and clothing products’ raw materials and goods are usually transported by sea, while electronic products might use air transport. For the plant, electronic industry require more dedicate and reliable electricity and power than other industries. Similar to agricultural processing industry, it requires purified water supply.

## 2.3 Infrastructure Evaluation Index

Several literature attempts to evaluate infrastructure by quantitative scores. Wheeler and Mody (1992) creates capital expenditure function to evaluate where to invest. The function includes ten variables. One of them is infrastructure quality that combines transportation, telecommunication and power infrastructure together by ranging the scores from 10 to 1. The score of “10” means that all infrastructures are in good quality and sufficient and “0” means no infrastructure for business. They found that infrastructure significantly affect the investment location in developing countries. However, the score is quite rough and does not apply to any specific industry. Later research reports and literature, e.g., World Economic Forum (2009), Kumar (2012) and World Bank (2012), etc., have introduced the concept of infrastructure evaluation or logistics infrastructure ranking for global investors. Although

their methods and rankings are quite acceptable, their focus is on country-level not city-level. Other indices are created for specific kinds of infrastructure. For example, Drahosava (2011) uses the Regional Competitiveness Index (RCI) to evaluate transportation infrastructure in Czech Republic regions. Rudjanakanoknad *et al* (2014) introduces port trade facilitation index to evaluate port infrastructure only.

From the literature, past research usually did infrastructure ranks by either macro-level or infrastructure-specific, which are not sufficient or suitable for investors to use it for location selection on city-level basis.

### 3. METHODOLOGY

The study methodology is composed of four steps. First, primary data are collected from field investigation and interviews of local governments and businessmen for infrastructure supply side. The data were then analyzed by infrastructure evaluation index (excellent = 4 to poor/not available = 1) for comparison purpose. Second, for infrastructure demand side, in-depth interviews of key businessmen in three industries were conducted. This is followed by questionnaires to all companies in industry organizations to survey the demand of locations and required infrastructures as well as the government policy that would be done to support Thailand foreign direct investment. Third, the infrastructure demand and supply data were compared and analyzed to observe the discrepancy between them. Lastly, the strategic maps for investment in each industry were drawn as well as the recommendations for government supportive policies are proposed after confirmation from a focus group to summarize the research.

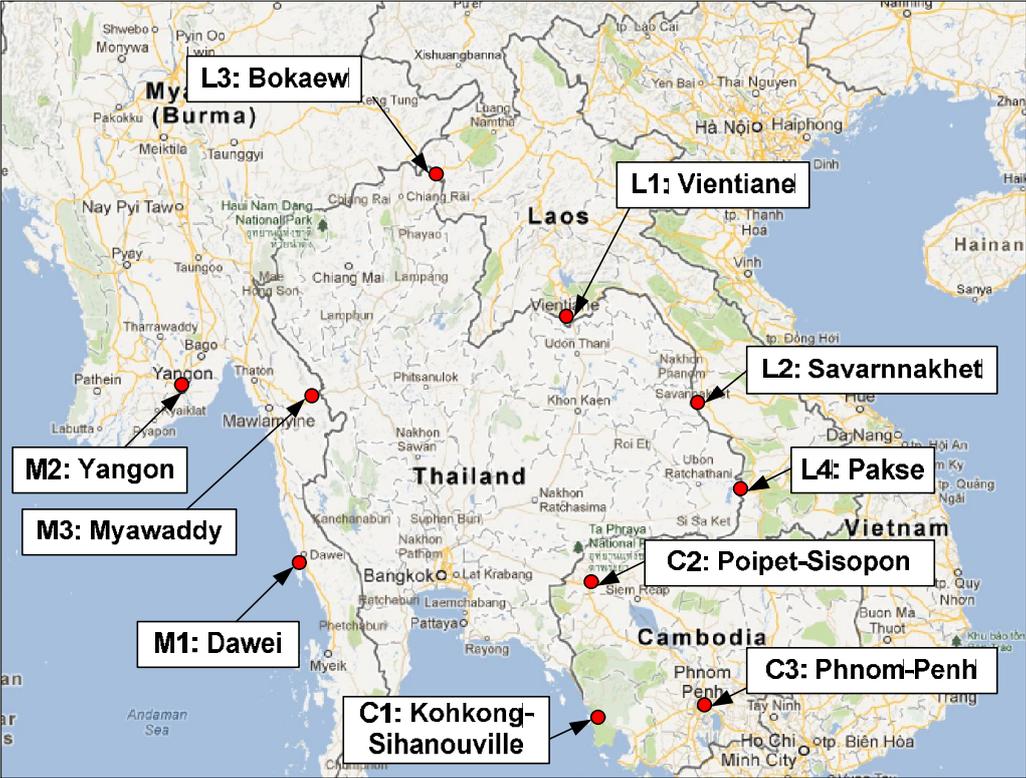


Figure 2. Targeted cities for Thai Foreign Direct Investment

The scope in this study includes ten cities shown in Figure 2 from neighboring countries (Cambodia, Lao PDR and Myanmar) and three industries are based on Thailand's Board of Investment recommendation.

For supply analysis, the infrastructure evaluation index was created. Each infrastructure will be graded into 4 main levels, which "4" means excellent condition for industry and "1" means no existence or in poor condition. For transportation infrastructures, the scores are based on their condition and proximity to the cities of interest. Some criteria were adjusted from international standards issued by United Nations (2001), Federal Railroad Administration (2011), and Wilbur Smith Associates (2010). The criteria in infrastructure evaluation index are shown in Tables 1 and 2 below.

Table 1. Criteria to evaluate local infrastructures

Type	Score	General Definition
Electricity and Power	4	Has sufficient quality electricity/power for industry without any seasonal interruption or shortage.
	3	Has sufficient quality electricity/power for industry for most time of years; interruption or shortage rarely happen.
	2	Has moderate quality electricity/power, shortage frequently happens and partially affects production.
	1	Has insufficient electricity/power which affects production significantly.
Telecommunication	4	Has quality wireless EDGE/3G/4G system and ADSL internet that fully covers the zone.
	3	Has quality wireless EDGE/3G/4G system and ADSL internet that covers most parts of the zone.
	2	Has low quality wireless EDGE/3G/4G system and internet, disruption frequently happens.
	1	Has no wireless EDGE/3G/4G or ADSL internet; difficult to connect others
Water Supply and Sanitary System	4	Has sufficient quality water supply for all seasons. Good sanitary system and no irrigation or flood problems.
	3	Has sufficient quality water supply for most seasons. Irrigation or flood problem could rarely happen.
	2	Has moderate quality water supply for most seasons or some parts of the zone. Irrigation or flood might happen.
	1	Has insufficient quality water supply or sanitary system; affect production significantly.

Table 2. Criteria to evaluate transportation infrastructures

Highway	speed > 120 km/hr	speed 90-120 km/hr	speed 50-89 km/hr	speed < 50 km/hr	Port	Berth L.>3km ,Depth> 14m	Berth L.1-3 km, Depth 8-14 m	Berth L.<1k m, Depth <8m	River Port
Motorway	4.0	3.5	3.0	2.5	within 10-km	4.0	3.5	3.0	2.5
Four-lane Highway	3.5	3.0	2.5	2.0	within 150km	3.5	3.0	2.5	2.0
Two-lane Highway	3.0	2.5	2.0	1.5	within 300km	3.0	2.5	2.0	1.0
Non-asphalt Highway	2.5	2.0	1.5	1.0	Out of 300km	1.0			

Railroad	speed > 120 km/hr	speed 90-120 km/hr	speed 50-89 km/hr	speed < 50 km/hr	Airport	2 Runways L >3.5km	1 Runway L > 2.5km	1 Runway L < 2.5 km
Connected	4.0	3.5	3.0	2.5	within 10-km	4.0	3.5	3.0
within 100km	3.5	3.0	2.5	2.0	within 100km	3.5	3.0	2.5
within 200km	3.0	2.5	2.0	1.5	within 200km	3.0	2.5	2.0
Out of 200km	1.0				Out of 200km	1.0		

## 4. DATA

### 4.1 Summary of Field Data on Infrastructures

General descriptions of ten cities and highlights of existing infrastructures are as follows:

*C1: Kohkong & Sihanouville* Kohkong is located adjacent to Klongyai, Trad, border province of Thailand. Kohkong Special Economic Zone currently has automotive parts, wire, sports equipment and clothing factories inside. Sihanouville is Cambodia's major port, located 227 km from Kohkong along Highway No.48. Cambodia promotes Sihanouville special economic zone, which has deep seaport, and railway connecting to Phnom Penh. The existing infrastructure problems are unreliable electricity in Kohkong and the sharp curve on highway No.48 that obstructs heavy truck transportation.

*C2: Poipet & Sisophon* Poipet is located adjacent to Aranyaprathet, Sakao, border province of Thailand. This zone is very close (240 km) to Thailand's Laemchabang port with reliable highway connectivity. There are Poipet-O'Neang and Sisophon Special Economic Zones to serve foreign investors. Major obstacles are insufficient electricity and water supply for industrial estates but they are under construction and improvement.

*C3: Phnom Penh* Phnom Penh, the capital of Cambodia, has lots of industrial zones mostly for textile & clothing, shoes, food processing, furniture, consumer products, etc. It has seven two-lane highways connecting to other provinces, airport and river port. These highways are under expansion to be four lanes. The infrastructure in this area is well-developed.

*M1: Dawei* Infrastructures in Dawei are under development to be a very large (204 sq.km.) industrial estate and deep seaport within 10-20 years. Now, the expressway connecting Karnchanaburi, Thailand to Dawei, new Dawei airport, new railway line, are under construction by the joint ventures from Thailand, Japan and others.

*M2: Yangon* Yangon, the largest city in Myanmar, has many industrial zones in suburb areas due to low wages but the logistics system are under development; electricity and water supply are insufficient for industry. There have been many complaints from investors regarding unreliable electricity system causing higher production cost. Yangon has several ports and international airports. There have been many Japanese and Thai owned industry in this area.

*M3: Myawaddy* Myawaddy is the trading city along with Mae Sot, Tak. Myanmar and Thai government is planning to build a dual special economic zone in both cities. However, Myawaddy's infrastructure is not well developed. The main road from Myawaddy to Yangon is in poor condition and the new road is being built. Water supply and electricity are still scarce. Also, the bridge connecting Mae Sot and Myawaddy is congested.

*L1: Vientiane* Vientiane, the capital of Lao PDR, is under development and has some industrial estate. The major connecting hubs for goods from Vientiane is Kunming, PRC and Laemchabang port, which are pretty far and rely on highway transport only. River transport along Mekong is unreliable. However, this city has sufficient electricity, water supply and good telecommunication network.

*L2: Savarnakhet* Savarnakhet-Savan Seno special economic zone is located on east-west economic corridor connecting to Danang Port, Vietnam and not far from Laemchabang Port, Thailand. It has good telecommunication network but electricity and water supply are being upgraded to serve much higher industry demand. Most industries in this zone are agricultural processing (sugar), logistics, and trade.

*L3: Bokaew* Bokaew is located on north-south economic corridor connecting to Kunming, PRC. This corridor is fully developed and mainly uses for truck logistics from Southern China to Thailand. Now, there are some Thai and Korean food processing companies in this city. It has good telecommunication network but electricity and water supply are being upgraded to serve much higher industry demand.

*L4: Pakse* Pakse is adjacent to Ubonratchathanee, Thailand. It can connect to Danang Port in Vietnam by highway. However, highways and railways to this city are being built. Electricity and water supply are under developed. Now, there are some Thai and Korean food processing companies in this city. Its current industries are tourist, electricity plant, and mining.

#### 4.2 Infrastructure Demand from Thai Investors

In-depth interviews were conducted with seven organizations, which are key stakeholders. They include Thailand's Board of Investment, National Economic and Social Development Board, Association of Electronic and Computer Employees, Thai Sugar and Bio-Energy Producers Association, Textile Industry Development Institute, Thai Frozen Foods Association and Thai Food Processors' Association. Major findings from the interviews are the infrastructure requirements in each industry and where Thai investors are interested in.

To quantitatively analyze infrastructure demand and understand the general view of Thai investors, 200 questionnaires were distributed to companies from three targeted industries. Among them, 51 questionnaires were returned as shown in Table 3.

Table 3. Numbers of questionnaires and respondents in each industry group

Industry Group	No. of Distributed Q.	No. of Returned Q.	% Returned
Textile and Clothing	50	21	42%
Electronic Parts	50	25	50%
Agricultural Processing	100	5	5%
<b>Total</b>	<b>200</b>	<b>51</b>	<b>26%</b>

Key results from the questionnaires are as follows. First, the textile and clothing as well as agriculture processing companies are very interested in foreign direct investment and most are on planning process, while the electronic parts industry has not started planning yet. Second, the major drives for their relocation to foreign countries are wage reduction, acquisition of natural resources, tax privilege, respectively. Third, Thai companies are mostly interested in Myanmar due to labor supply; however, agricultural processing companies are interested in Lao PDR due to larger area of cultivation.

Investors express their factors that affect location choice into four score level from “1”- not important at all to “4” – very important. The scores are then averaged to show the degree of importance for their decision as shown in Table 4. The highlighted numbers in this table show the scores that are higher than 4.5 meaning that these are very important factors in each industry. It shows that transportation infrastructures, utilities, and regulations play important roles in investor decision although the most influential factor is low labor wage. Note that due to very low survey responses from agricultural processing companies, the results from this group might be statistically inconclusive.

Table 4. Factors affecting investors’ decision regarding location choice

Factors	Textile and Clothing		Electronic Parts		Agriculture Processing	
	Avg.	SD.	Avg.	SD.	Avg.	SD.
1. Close to raw material source	3.38	0.67	3.36	0.76	<b>3.80</b>	0.45
2. Close to port or distribution terminal/market	3.43	0.51	3.44	0.77	<b>3.60</b>	0.89
3. Low labor wage	<b>3.90</b>	0.30	<b>3.52</b>	0.71	<b>4.00</b>	0.00
4. Proficiency of local workers	3.33	0.48	3.44	0.77	3.20	0.45
5. Relationship with local government or politicians	3.14	0.57	3.28	0.68	3.00	0.71
6. Privilege in tax exemption or reduction	<b>3.52</b>	0.51	<b>3.52</b>	0.51	<b>3.80</b>	0.45
7. Good banking and financial infrastructure	3.19	0.68	3.40	0.58	<b>4.00</b>	0.00
8. Good transportation infrastructure	<b>3.62</b>	0.50	<b>3.60</b>	0.50	<b>3.80</b>	0.45
9. Good utilities (electricity, water supply, telecom)	<b>3.71</b>	0.46	<b>3.52</b>	0.59	<b>4.00</b>	0.00
10. Regulation and support from Thai government	<b>3.67</b>	0.58	<b>3.52</b>	0.51	<b>4.00</b>	0.00
11. Regulation and support from local government	<b>3.57</b>	0.60	<b>3.56</b>	0.51	<b>4.00</b>	0.00
12. Requirements from partners/headquarter	3.43	0.51	3.40	0.50	<b>3.60</b>	0.55

Table 5. Effect of infrastructures on investors’ decision regarding location choice

Infrastructure Type	Textile and Clothing		Electronic Parts		Agriculture Processing	
	Avg.	SD.	Avg.	SD.	Avg.	SD.
Highway	<b>3.67</b>	0.59	3.48	0.71	<b>3.80</b>	0.45
Railway	2.89	0.68	3.04	0.73	2.80	1.10
Seaport	3.39	0.70	3.24	0.60	3.00	0.71
Airport	3.12	0.60	3.48	0.59	2.80	0.45
Electricity and Power	<b>3.88</b>	0.33	<b>3.76</b>	0.44	<b>4.00</b>	0.00
Telecommunication	<b>3.59</b>	0.62	<b>3.68</b>	0.48	<b>3.80</b>	0.45
Water Supply and Sanitary	<b>3.56</b>	0.62	<b>3.68</b>	0.48	<b>4.00</b>	0.00
Cross-Border Transport Facility	<b>3.61</b>	0.61	<b>3.64</b>	0.49	<b>3.80</b>	0.45

The questionnaires also ask companies to rate the degree of importance for each infrastructure type. The results in Table 5 show that electricity and power, telecommunication, water supply and sanitary as well as cross-border transport facility are very crucial for investors. Highways are very important to textile and clothing and agricultural processing industries also since all raw materials and products are transported on road.

The last part of questionnaire asks investors to rank the supportive policies from Thai government. We found that most investors would like the government to protect their investment by establishment of insurance fund, to negotiate with neighboring countries on regulations and privilege for Thai investors. In addition, they would like Thai government to build FDI information centers in Thailand and neighbors for their study and planning.

## 5. COMPARISON OF INFRASTRUCTURE DEMAND AND SUPPLY DATA

To compare infrastructure supply data from field survey with investors' demand data from questionnaires. The weights of infrastructure score for each industry type were developed by consulting with experts from each industrial association. The results are shown in Table 6. Note that the differences among industry are due to various products time-sensitivity that affect transportation mode choice, market location, and production requirements.

Table 6. Effect of infrastructures on investors' decision regarding location choice

Industry Type	Weights of Infrastructure Score						
	Highway	Rail	Port	Airport	Electricity	Water supply	Telecom
Textile & Clothing	25	0	15	10	10	25	15
Electronic parts	30	0	0	15	15	25	15
Agriculture Processing	25	5	15	0	15	20	20

By using weights in Table 6, we can obtain the total score for each industry. The total score is ranged from 1 to 4. We can interpret the total score as follows:

- Total Score  $\geq 2.5$  ; Infrastructure in this area is highly ready for an industry. (★★★)
- $2.5 > \text{Total Score} \geq 2.0$  ; Infrastructure in this area is moderately ready for an industry. (★★)
- Total Score  $< 2.0$  ; Infrastructure in this area is not ready for an industry. (★)

In addition, the infrastructure evaluation scores and investor demand score for each infrastructure are compared by calculating simple difference between these two ( $\Delta = \text{Infrastructure Evaluation Score} - \text{Investor Demand Level}$ ). The interpretation of  $\Delta$  is as follows:

- $\Delta \geq 0$  ; Infrastructure can serve investor demand perfectly (**Great**)
- $-1 \leq \Delta < 0$  ; Infrastructure can serve investor demand mostly, some upgrade might be needed for future higher demand (**Good**)
- $-2 \leq \Delta < -1$  ; Infrastructure can serve investor demand partly, major upgrades are required to satisfy existing demand (**OK**)
- $\Delta < -2$  ; Infrastructure cannot serve investor demand at all (**Poor**)

Base on the above criteria, the level of infrastructure readiness for the textile and clothing industry can be shown in Table 7.

Table 7. Level of infrastructure readiness for textile and clothing industry

Infrastructure Type	Cambodia			Myanmar			Lao PDR			
	C1	C2	C3	M1*	M2	M3	L1	L2	L3	L4
Highway	OK	Good	OK	OK	Poor	OK	OK	OK	Good	OK
Railway	Good	Good	Good	Good	Good	OK	Good	OK	OK	OK
Seaport	OK	Good	Good	Great	Good	OK	Poor	Poor	OK	Poor
Airport	Great	Good	Great							
Electricity and Power	OK	OK	Great	Good	OK	Poor	Great	OK	OK	OK
Telecom.	OK	OK	Good	Good	OK	Poor	Good	Good	OK	Good
Water Supply & Sanitary	Great	Great	Great	Good	OK	OK	Great	Good	Good	Good
<b>Total Score</b>	<b>2.70</b>	<b>2.65</b>	<b>3.23</b>	<b>3.03</b>	<b>2.25</b>	<b>1.79</b>	<b>2.88</b>	<b>2.28</b>	<b>2.38</b>	<b>2.38</b>
<b>Category</b>	<b>★★★</b>	<b>★★★</b>	<b>★★★</b>	<b>★★★</b>	<b>★★</b>	<b>★</b>	<b>★★★</b>	<b>★★</b>	<b>★★</b>	<b>★★</b>

Note \*M1 (Dawei) is assumed that all infrastructures are completely built according to plan.

Table 7 shows that the suitable areas for Thai outward investment are Kohkong-Sihanouville, Poipet-Sisophon, Phnom Penh, Vientiane and Dawei (next 5 years) due to infrastructure readiness that serve investor demand. Nevertheless, government supports are still required for some infrastructure in some areas. For example, Lao PDR zones are far away from seaport. Good highways or a railway are required to ship the products to Laemchabang or Danang ports. Bokaew is Lao's only area with a river port that can connect to Southern China through Mekong; however, Mekong can only use seasonally due to extreme fluctuating water level. For Myawaddy, which is an only 1-star category zone, it is not suitable yet for textile and clothing industry. If the government plans to promote this zone, the whole infrastructure development is required and it would take longer than 5 years to be ready for that. The strategic investment map for textile and clothing industry is shown on the upper-left of Figure 3. Note that each color means the level of infrastructure readiness.

Similarly, from the analysis, the area with high infrastructure readiness for electronic parts industry are Phnom Penh, Kohkong-Sihanouville, Poipet-Sisophon and Dawei. For Vientiane, and Pakse, the logistics can be done through air transport and highway. For Savarnakhet and Bokaew, they require electricity upgrade. For Myawaddy, the area is not ready for this industry due to very poor roadway, unreliable electricity, water supply and telecommunication network. The strategic investment map for electronic parts industry is on the upper-right of Figure 3.

For the agricultural processing industry, the results are related. The areas with high infrastructure readiness are Phnom Penh, Kohkong-Sihanouville, Poipet-Sisophon, Dawei, and Vientiane. Yangon might be ready if highways connecting to the port is upgraded. Also, Myawaddy is not ready for the industry at all. The strategic investment map for agricultural processing industry is on the lower-left of Figure 3.

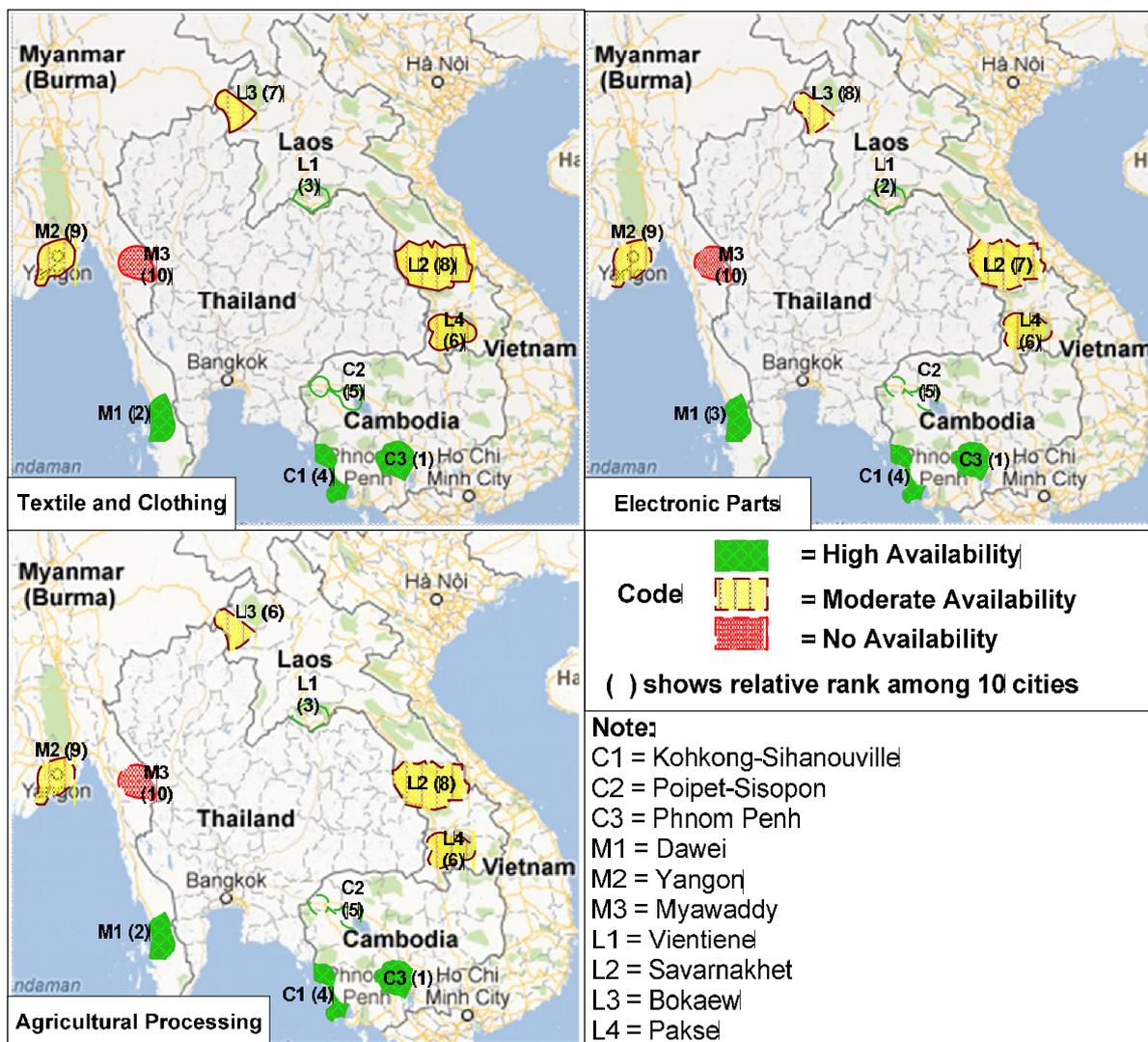


Figure 3. Strategic maps for Thai Foreign Direct Investment in each industry

The findings from strategic maps and the level of investor interest can be used to prioritize or justify where Thai government subsidization or collaboration is needed. In general, the areas with high investor interest but poor infrastructure readiness would require support firstly. Subsequently, ones with high interest but moderate or good infrastructure readiness would require partially support to upgrade some of their infrastructures. On the other hand, the support on areas with low investor interest would be done last. The recommendations of appropriate level of support from Thai government can be summarized in Table 8. This guideline can be used for proposing recommendations in the last chapter.

Table 8. Appropriate level of support from Thai government

Level of Investor Interest	Level of Infrastructure Readiness		
	Good	Moderate	Poor
High	Might Partially Support	Need Moderate Support	Require Critical Support
Moderate	Might Partially Support	Might Partially Support	Need Moderate Support
Low	No Support is needed	No Support is needed	No Support is needed

## 6. RECOMMENDATIONS AND CONCLUSION

From the analysis, the recommendations to establish an industry according to infrastructures are the followings:

*Textile and clothing industry* This industry requires a convenient highway connecting to a port as well as good electricity, water supply, and telecommunication systems. The findings show that investors are interested in Vientiane, Yangon, Poipet-Sisophon, respectively, while the areas with high infrastructure availability are Phnom Penh, Dawei, Vientiane, and Kohkong-Sihanouville, Poipet-Sisophon. Therefore, Thai government would invest more in transportation infrastructure (highway/railway) connecting Laemchabang port to Vientiane, railway, electricity and water supply system in Poipet-Sisophon.

*Electronic parts industry* This industry requires a convenient highway connecting to an airport as well as excellent electricity and telecommunication systems. The findings show that investors are interested in Vientiane, Yangon, Phnom Penh, Poipet-Sisophon, and Savarnakhet respectively. Therefore, Thai government would invest more in electricity and water supply system in Poipet-Sisophon. For Yangon, Thai government would support the establishment of Thai companies in Yangon industrial estate with reliable electricity system.

*Agricultural processing industry* This industry requires a sanitized water supply and good highway/railway connection to a seaport. The findings show that investors are interested in Yangon, Vientiane, Kohkong-Sihanouville, respectively. In this regard, Thai government would invest more in transportation infrastructure (highway/railway) connecting Laemchabang port to Vientiane, water supply system in Kohkong-Sihanouville and Yangon.

Besides area and industry specific recommendations, we found that infrastructure in neighboring countries require Thai government support to expedite their developments. It is recommended that Thai government would establish an assistance to build electricity and water supply system in their industrial estates. It might be started by constructing generating station or water supply plant. In addition, the connection between Thai and neighboring factories would become much more cohesive along supply chain. Therefore, much better trade facilitation and cross-border transportation through capacity expansion and border area and customs management are required. This could also be done by establishing dual special economic zones at border towns. Lastly, it might be compulsory that Thai government would subsidize transportation infrastructure such as highway and railway connecting to neighboring country's industrial towns. Other recommendations from investors are that Thai government would do more in negotiating tariff and non-tariff barriers with neighboring countries to assist Thai investors. Also, information centers in Thailand and targeted cities would be instituted to inform and assist the investors.

Lastly, this research provides a new analytical platform to evaluate infrastructures in city level to serve investor demand. The criteria in evaluation might be adjusted in case of other industries such as shoes and leather, jewelry, tourist services, etc. Future works might be done by including other factors that are related to investor decision such as labor supply and wage, raw material costs, tax privilege, local regulations, etc. This would be studied in details how to incorporate them.

## ACKNOWLEDGEMENTS

This research is jointly funded by the Thailand Research Fund (Division 1) with contract No. RDG5610012. The views expressed herein are those of the authors and are not necessarily approved by the funders. Also, the authors would like to thank Assistant Professor Dr. Kornkarun Cheewatrakoolpong, Dr. Narong Pomlaktong and Associate Professor Dr. Pattamawadee Pochanukul that provided helpful suggestions for this study.

## REFERENCES

- Drahosova, J. (2011) Evaluation of transport infrastructure in regions of the Czech Republic. *Perner's contact*, Vol. 6, 58-73.
- Federal Railroad Administration. (2011). *United States Code of Federal regulations Title 49* [Online] <http://www.fra.dot.gov> [2014, July 20]
- Kumar, N. (2012) *Infrastructure Availability, Foreign Direct Investment Inflows and Their Export-orientation: A Cross-Country Exploration*. [Online]. <http://depot.gdnet.org/> [2013, July 22]
- Rudjanakanoknad, J., Sukdanont, S., and Suksirivoraboot, W. (2014) Evaluation of International Ports in Thailand through Trade Facilitation Indices from Freight Forwarders, *Procedia - Social and Behavioral Sciences*, Vol.111, 1073-1082.
- United Nations. (2001) *Asian Highway Classification and Design Standards* [Online], <http://www.unescap.org/ttdw/common/tis/ah/AnnexII-E.pdf>. [2014, July 20]
- Wheeler, D. and Mody, A. (1992) International Investment Location Decisions: The Case for US Firms, *International Economics*, Vol. 33, issue 1-2, 57-76.
- Wilbur Smith Associates. (2010) Wisconsin State Airport System Plan – Airport Classification Review & Update, *Research Report*, 33-36.
- World Bank. (2008) Thailand Infrastructure Annual Report 2008, *Research Report*, 8-13.
- World Bank. (2012), Connect to the Complete 2012 Trade Logistic in the Global Economy: The Logistics Performance Index and its Indicators, *Research Report*, 51-54.
- World Economic Forum. (2010) *The Global Competitiveness Report 2009-2010* (geneva: SRO-Kunding), 3-7.