

## **A Location Analysis of the Distribution Center and Logistics Hub in The Greater Mekong Subregion**

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— *Review of* —  
**Integrative  
Business &  
Economics**  
— *Research* —

### **ABSTRACT**

Agriculture is a significant sector of most of the economy of world. Rice, corn and longan as an example of this study are used as the product that can be sold in an Agricultural Products' Distribution Center with high demand because people consume them on a daily basis. Rice, corn and longan are an agriculture product important to Thailand's economy. They are mainly export to other countries all around the world. To improve distribution channel in the Agricultural Products' Distribution Center, infrastructure and facility may need to be used for supporting a distribution of raw materials to the factory, and finished products to the customer. For Thailand, it has played an important role and is aimed at becoming the logistics hub in the Greater Mekong Sub-region (GMS). In order to accomplish this main objective, logistics is being employed as a strategic plan to gain a competitive business advantage. The concept of logistics will put Thailand in the position of becoming an Agricultural Products' Distribution Center in the GMS. Setting a strategic plan of the North-South and East-West Corridor would be more supportive for Thailand to gain a better competitive advantage. Considering the North-South corridor, Chiangrai province is located near the countries such as China, Myanmar, or Laos among the GMS border. Chiangrai is one of the Northern provinces that have sufficient infrastructure and transportation network, covering road, rail, air, and water transportation modes. The main objectives of this study are to: 1) study a pattern of collection, distribution, area, and volume of agricultural products in the area of Chiangrai and 2) analyze conditions for an appropriate location of the Agricultural Products' Distribution Center. In summary, a location of Chiang Khong District was the best alternative for becoming the Agricultural Products' Distribution Center. This selected Chiang Khong District location (according to technique, physical, economy, and social) was better than location of Chiang Saen and Mae Sai District, respectively.

### **KEYWORDS**

Agricultural Products' Distribution Center, Logistic Hub, Hub and Spokes, Greater Mekong Sub-Region

### **INTRODUCTION**

Agriculture is a significant sector of most of the economy of world. Agriculture derives its importance from the fact that it provides any a country self reliance in terms of food for their people, providing huge direct and indirect employment and more over huge revenue by export of surplus food grain. Agriculture is backbone of the economy and infrastructure for many countries. Due to technical advancement, improved irrigation system and several other reasons production in agriculture has increased several folds. To meet this increased production and business in agriculture sector an equally reliable supply chain support is imperative. Agricultural products such as rice, corn and longan are the product that can be sold in an Agricultural Products' Distribution Center with high demand because people consume them on a daily basis. These products are easily decayed and perishable, so they should be immediately distributed to a consumer. In order to distributing to the end customer, location network or marketing is necessary. Rice, corn and longan are an agriculture product important to Thailand's economy. They are mainly export to other countries all around the world. For Thailand, it has played an important role and is aimed at becoming the logistics hub in the Greater Mekong Sub-region (GMS). In order to accomplish this main objective, logistics is being employed as a strategic plan to gain a competitive business advantage. The concept of logistics will put Thailand in the position of becoming an Agricultural Products' Distribution Center in the GMS. Setting a strategic plan of the North-South and East-West Corridor would be more supportive for Thailand to gain a better competitive advantage. Considering the North-South corridor, Chiangrai province is located near the countries such as China, Myanmar, or Laos among the GMS border. Chiangrai is one of the Northern

provinces that have sufficient infrastructure and transportation network, covering road, rail, air, and water transportation modes. Nevertheless, to improve distribution channel in the Agricultural Products' Distribution Center, infrastructure and facility may need to be used for supporting a distribution of raw materials to the factory, and finished products to the customer. Using the distribution channel may allow Thai farmers to sell and distribute their agricultural products to fulfil a customer demand.

Therefore, this research study is aimed at investigating a system of the Agricultural Products' Distribution Center in the upper-northern part of Thailand that has physical conditions appropriate for growing fruit and vegetables. At the present time, growing rice, longan, and corn have been selected to fulfil export purposes. This Agricultural Products' Distribution Center is thought to be capable of balancing supply and demand with collecting and distributing the products. The main objectives of this study are to: 1) study a pattern of collection, distribution, area, and volume of agricultural products in the area of Chiangrai and 2) analyze conditions for an appropriate location of the Agricultural Products' Distribution Center.

## **LITERATURE REVIEW**

### ***Theory and Definition***

#### **Location Theory**

The location theory explains how to select the location that is contributed to the Thai economy. Such location theory is classified into 2 main groups: least cost location theory and profit maximization theory.

##### *1. Least cost location theory*

Alfred Weber formulated a least cost theory of industrial location which tries to explain and predict the location pattern of the industry at a macro-scale. It emphasizes that firms seek a site of minimum transport and labor cost. The point for locating an industry that minimizes costs of transportation and labor requires analysis of three factors: Material Index, Labor, Agglomeration and Deglomeration.

##### *2. Profit maximization*

-Factor rating method is a technique that can be applied to a wide range of decisions ranging from personal to professional. It is a general approach useful for evaluating a given alternative and comparing alternatives, and enables decision makers to incorporate their personal opinions and quantitative information in the decision process.

-Break even analysis method is a useful tool to study the relationship between fixed costs, variable costs and returns. A break-even point defines when an investment will generate a positive return and can be determined graphically or with simple mathematics. Break-even analysis computes the volume of production at a given price necessary to cover all costs.

-Center of gravity method is a method to determine the location of a distribution center that will minimize distribution costs. The method includes the use of a map that shows the locations of destinations.

-Transportation model finds amount to be shipped from several sources to several destinations. It is used primarily for industrial locations.

#### **Distribution/Distribution Systems**

Physical distribution is "the collective term for the range of activities involved in the movement of goods from points of production to final points of sale and consumption. It must insure that the mobility requirements of supply chains are entirely met." Physical distribution includes all the functions of movement and handling of goods, particularly transportation services (trucking, freight rail, air freight, inland waterways, marine shipping, and pipelines), transshipment and warehousing services (e.g. consignment, storage, inventory management), trade, wholesale and, in principle, retail. Conventionally, all these activities are assumed to be derived from materials management demands.

Distribution Systems are embedded in a changing macro- and microeconomic framework, which can be roughly characterized by the terms of flexibilization and globalization:

- 1) Flexibilization implies a highly differentiated, strongly market and customer driven mode of creating added-value. Contemporary production and distribution is no longer subject to single-firm activity, but increasingly practiced in networks of suppliers and subcontractors. The supply chain bundles together all this by information, communication, cooperation, and, last but not least, by physical distribution.
- 2) Globalization means that the spatial frame for the entire economy has been expanded, implying the spatial expansion of the economy, more complex global economic integration, and an intricate network of global flows and hubs.

The flow-oriented mode affects almost every single activity within the entire process of value creation. The core component of materials management is the supply chain, the time- and space-related arrangement of the whole goods flow between supply, manufacturing, distribution and consumption. Its major parts are the supplier, the producer, the distributor (e.g. a wholesaler, a freight forwarder, a carrier), the retailer, the end consumer, all of whom represent particular interests.

### *Literature Survey*

Lee and Oum (2001) proposed the strategies for making Korea a Northeast Asian Logistics/Distribution Hub country. After summarizing the recent trends of multinational firms' logistics and distribution practices and the conditions of successful logistics hubs, we identified the potential advantages of Korea over Japan and China, and examined the success cases of the Netherlands and Singapore. This allowed us to make a number of suggestions to help make Korea attractive to foreign multinationals as the place to locate their northeast Asian regional distribution centers.

Chin and Tongzon (2001) studied transportation Infrastructure Management for Attracting Global and Regional Distribution Centers in Singapore. The success of Singapore as a major transshipment hub must due to the presence of a world class transportation system with world class players such as SIA and PSA capitalizing on Singapore's comparative advantage in location, which began with the development of the port followed by air and land. The land, sea and air sectors have taken an independent approach to development and investment in the past. Multi-modalism in the cargo industry demands instant acquisition, processing and analysis of data; thereby logistics is that vital link to enhancing production, distribution and consumption.

Laptaned and Rattanawong (2005) investigated an evaluation of distribution center location for Phitsanulok province that may become the future of a Logistics Center in Indo-China. From an initiative of the Asian Development Bank (ADB) to determine a regional plan of developing North-South economics corridor and East-West economics corridor in Indo-China region. Such development addresses a multi-sectoral perspective, spatial development options, and practical infrastructure, human resource, policy, regulatory and institutional barriers to trade, investment, and the movement of goods and people. Considering an intersection of both corridors, Phitsanulok province is located right on the section and has become a logistics center of Indo-China intersection. Phitsanulok is one of the Northern provinces that has sufficient infrastructure and transportation network, covering road, rail, air, water, and pipe transportation modes. It is therefore appropriate for Phitsanulok to be a distribution center of Indo-China intersection that may serve trade/commodity flow among Greater Mekong Sub-region countries. This study is aimed at 1) locating the appropriate location of a distribution center, 2) studying behavior of commodity flow, and 3) promoting and increasing awareness of business competitive advantage to farmers, agricultural sector, and private sector. Moreover, one-stop border facilities, sharing social and physical infrastructure, cross-border production networks, etc) to increase investment returns using existing transport modes (roads, water, air, and rail) are also reviewed.

Sene, et al., (2006) proposed the inter model routings solution of Thailand-China shipments under FTA using fuzzy AHP. This paper deals with a method to solve transport problems. There are many routings possibilities between Thailand and China where the countries are under Free Trade Agreement. For example, the goods can transit through Laos, through Myanmar or on the Mekong River by ship. All possibilities are available but we need to choose the best one according to fuzzy criteria. This study will use the method to find the best routing. Fuzzy AHP uses linguistic variables to assess the ratings and the weights for quantitative or qualitative factors such as cost, time, risk and other performances. These linguistic ratings can be expressed in trapezoidal or triangular fuzzy numbers. A MCDM model is then proposed to deal with the selective problem. To determine the ranking order or each possible solution, a closeness coefficient is defined by calculating the distances to the both fuzzy positive ideal solution (FPIS) and fuzzy negative ideal solution (FNIS) simultaneously.

Thiengburanathum, et al. (2006) stated that the Kunming-Bangkok expressway is expected to be an important infrastructure in the GMS region. The logistics infrastructure functions as a land bridge between China and Asian

countries, particularly in Thailand. Once the project is fully functional, significant impacts can be anticipated, such as shifts of transportation mode, short and long term of economics and cultural changes. A schematic model is presented in this paper as a schematic decision making tool for evaluating transportation mode and route selection. This model is grounded on Stochastic and Analytical Hierarchy Process (AHP) techniques. The dimensions of cost, time, and reliability of service are integrated as key performance indices of the logistics system. Each business type has different kinds of requirements. The results show that this expressway will be a major logistics channel between Thailand and the Southern part of China.

Bremer Institut für Produktion und Logistik GmbH (2007) conducted research on the projects in the Enterprise Logistics Cluster that aim to develop and demonstrate advanced IT solutions for the design, management and control of enterprise logistics chains. It took into consideration both intra- and inter-enterprise logistics chains. The Enterprise Logistics Cluster relates to the domain 8 R&D areas of the ESPRIT Work Programme such as Management Tools for the Virtual Enterprise and Intelligent Production Systems and Equipment. The activities of the Working Group may be summarized in enhancing logistic RTD results of the Enterprise logistics cluster, to provide a dissemination and exploitation framework for those logistics RTD-projects and topics as a knowledge pool for European industry. To increase logistic perception and implementation, logistic minded bodies for systems uptake are identified and collaborations are carried out.

The Singapore Economic Development Board (2007) stated that a robust Logistics & Transport cluster will strengthen Singapore's capabilities as a compelling hub in Asia for business and investment. It was aimed at developing Singapore into an integrated and connected Logistics & Transport hub that enables the effective flow of goods, information, finances and people. Singapore continued to broaden and deepen the scope of activities of the cluster for growth in areas such as aviation services, oil and gas exploration and production, distributed power, automotive electronics, and SCM. Through strengthening manpower capabilities and infrastructure, it was also aimed at developing Singapore into a choice location for the entire value chain of Logistics & Transport activities including R&D, testbedding, manufacturing, after-market services and HQ centers.

Banomyong (2009) conducted research on the Asian and China logistics that was used to support private sectors who supervise and identify a framework of the Asian cooperation regulations. This research also investigated a framework of transportation model and a cooperation of economics in the GMS such as cross-border transportation agreement. Such agreement has become one of the critical problems in a way that it could solve the problem of international trucks crossing other countries. In order to achieving a single standard, the cross-border transport needs to be more effective and less time spending, especially for agricultural products.

The above literatures related to the Agricultural Products' Distribution Center are used as a reference to indicate the potentiality of successful logistics hubs in which Thailand is finally aimed at becoming the logistics hubs in Indo-China. Therefore, the logistics center presented in the literature survey located in Korea and Singapore, or the logistics cluster located in Germany and Singapore may be exemplary for Chiangrai becoming the Agricultural Products' Distribution Center of Indo-China region.

## **AGRICULTURAL PRODUCTS' DISTRIBUTION CENTER FOR CHIANGRAI**

### ***Supply Chain of Agricultural Products***

#### **Non Perishable Products**

Most all the cereals like Wheat, Rice, Maize etc. and some vegetables like Potato and Onion are highly inelastic in demand, more over they are not highly perishables so the supply chain for such products should focus more on efficiency and cost effectiveness than responsiveness. These products have vital supply and demand links with the market. Cereals needs some kind of processing and polishing after they are harvested from field and from here onwards supply chain comes into play. The food grain is then packed in jute bags and then stored in cold storages till they get order from market.

These type of agricultural products are highly in elastic in demand and the demand more or less remains constant so their demand can easily be forecasted and hence while designing supply chain for such products efficiency should be more preferred.

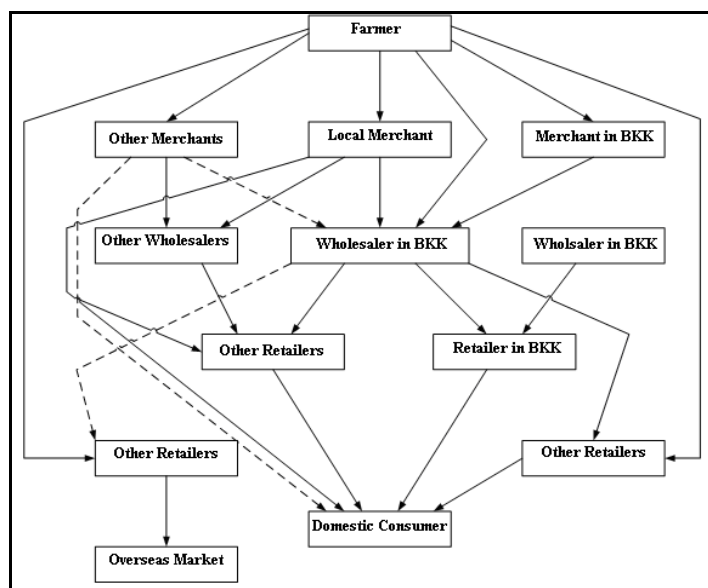
**Perishable Products**

Fruits, green vegetables and flower come under perishable items and they need all together a more responsive, fast and accountable supply chain as a means of propagation from farms to the market. These products are elastic and erratic in demand hence their demand forecasting is also difficult. They need more costly type cold storage and refrigeration, special transportation mechanism and on time delivery, all these requirements make this supply chain very costly, but at the same time the price of these products are consummately adjusted to ensure higher margin and profit. While designing supply chain for such items main focus should be given on the responsiveness.

A dispersion of agricultural land use is found in the upper northern part and lower northern part of Thailand. Rice, longan and corn are distributed from farm to a consumer through the wholesalers located in Chiangrai. Chiangrai is thought to be a central location where collects and distributes those agricultural products to other nearby provinces. In the north of Thailand, one of the best places to plant longan is Lamphun province. However, rice and corn can be found in the Northeast region. The major crops in the Northeast region are rice, cassava, corn, kenaf, and sugar cane and the other oil crops. Rice is grown in the lowlands and up to the middle of the terrace occupying about two-thirds of the cultivated land. However, it is grown primarily for home consumption. Corn is the most important field crops occupying the major portion of upland areas, and is localized in fertile soils.

These products will flow into a local market or other markets in other provinces that pass Pichit, Phitsanulok, or Nakornsawan provinces. It will then be delivered to Chiangmai and Chiangrai province where a central market in the upper northern part of Thailand is. Other products will be delivered to Bangkok and continued to other nearby provinces. Such commodity flows will generate a connectivity of economy among provinces due to ongoing activities such as collection, transportation, segregation, trading, etc. These activities are thought to add more value according to what extent of product volume, type, or time to market that flow to the other wholesalers, local wholesalers, other retailers, local retailer, wholesaler and retailer located in Bangkok illustrated in Figure 1.

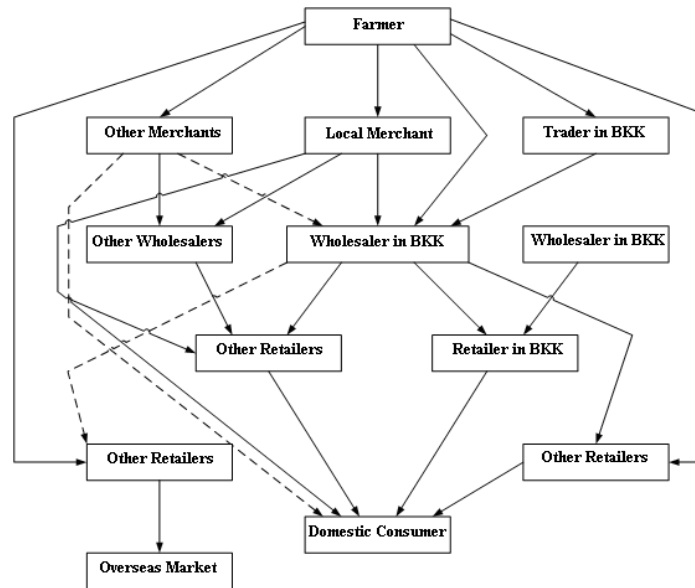
**FIGURE 1  
SUPPLY CHAIN OF AGRICULTURAL PRODUCTS (RICE, LONGAN, AND CORN)**



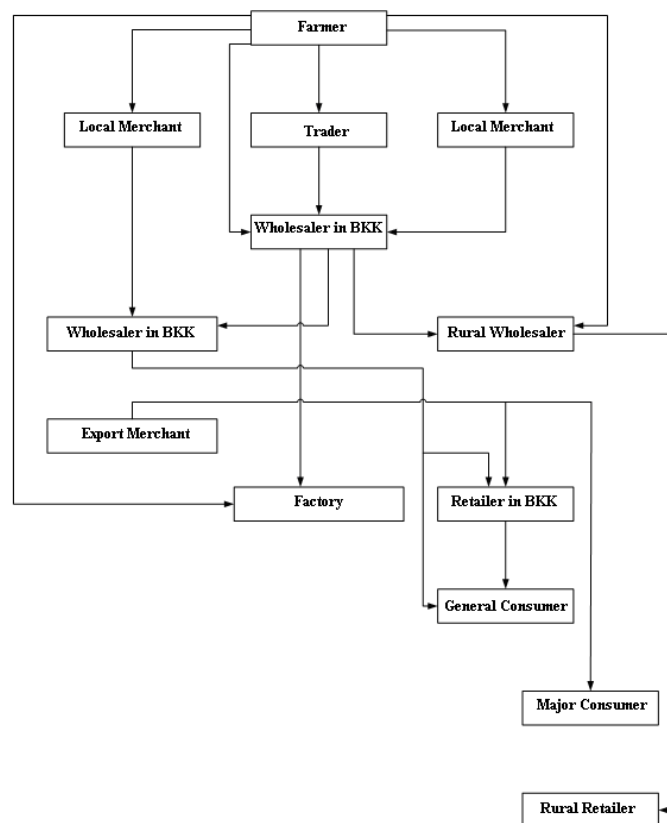
**Commodity Flow of Agricultural Products**

Figure 2 and Figure 3 illustrates the commodity flow of Rice/Longan and Corn that happens to the other wholesalers, local wholesalers, other retailers, local retailer, wholesaler and retailer in Bangkok or overseas market.

**FIGURE 2  
COMMODITY FLOW OF RICE AND LONGAN**



**FIGURE 3  
COMMODITY FLOW OF CORN**



### METHODOLOGY

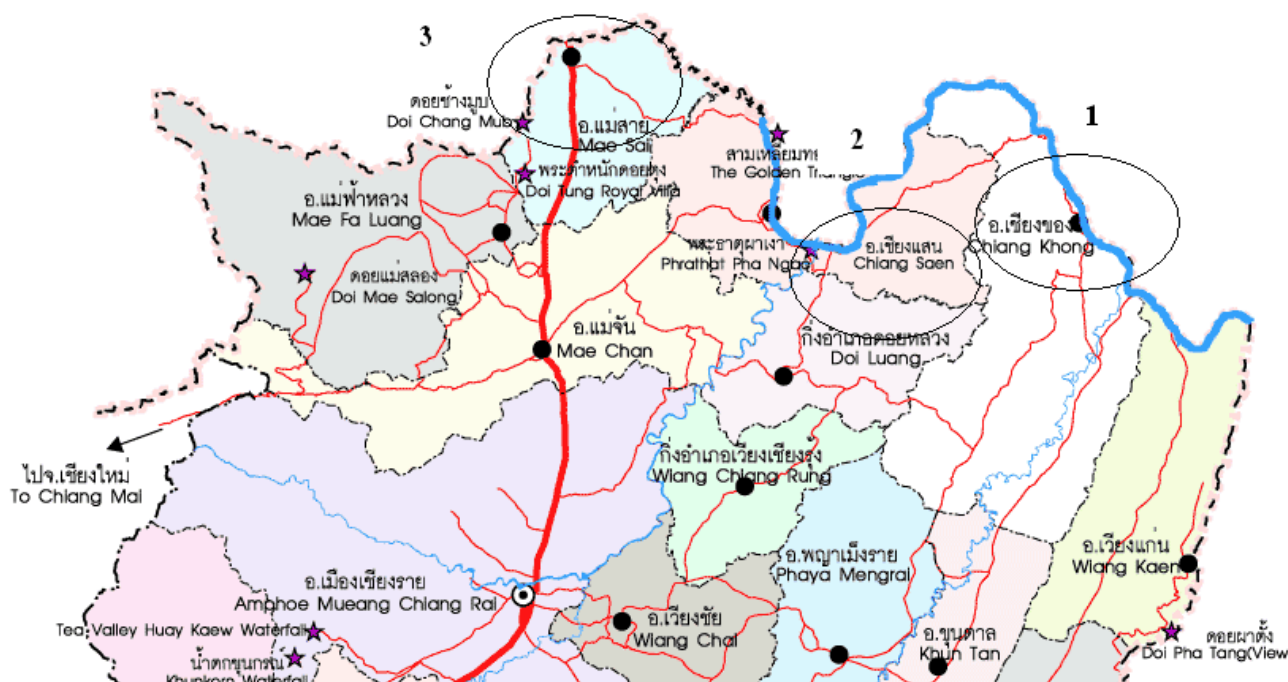
Collected data was classified into 2 categories: primary and secondary data. The primary data includes behavior of community flow such as population (i.e., third party logistics service provider – 3PLs), area of data collection, and sampling group, number of sampling, and method of data collection (i.e., sampling, interview). The primary data also includes current market price of land for the Agricultural Products’ Distribution Center development. It was collected through the interview with those located in Chiangrai such as suppliers, companies, freight forwarders, local people, brokers, or land bureau. The secondary data was collected, in forms of, business type, product or service given, raw materials' source, production distribution, mode of transportation, or distribution center's need.

### RESULTS ANALYSIS

This study conducted a survey and evaluated a three potential location that was found to be appropriate for developing the Chiangrai's Agricultural Product’s Distribution Center show below:

- (1) Location Chiang Khong District
- (2) Location Chiang Saen District
- (3) Location Mae Sai District

**FIGURE 4**  
**APPROPRIATE LOCATION FOR AGRICULRAL PRODUCTS’ DISTRIBUTION CENTER DEVELOPMENT**



Criteria of evaluating the Agricultural Product’s Distribution Center may include technique, physical, economy, and social factors. Such factors were weighted by the use of average weight scores of each location. The scores of each location was then summed up and used for a final evaluation. All locations illustrated in Table 1 are shown as follows:

**TABLE 1**  
**CRITERIA OF WEIGHT AND SCORE IN EACH LOCATION**

Factors	Weight	Chiang Khong	Chiang Saen	Mae Sai
<b>1. Technique</b>	<b>15%</b>			
1.1 Laws constraint	3%	4 (6)	4 (6)	6 (4)
1.2 Layout constraint	4%	2 (8)	4 (6)	4 (6)
1.3 Environment constraint	8%	2 (8)	4 (6)	4 (6)
<b>2. Physical</b>	<b>40%</b>			
2.1 Area of land	5%	10	8	6
2.2 Shape of land	4%	10	8	6
2.3 Condition of land before development	5%	10	6	6
2.4 Facility and utility	8%	4	8	10
2.5 Road access	10%	4	8	10
2.6 Water access	3%	6	8	8
2.7 Rail access	3%	2	2	2
2.8 Air access	2%	2	2	2
<b>3. Economy</b>	<b>30%</b>			
3.1 Price of land	10%	6 (4)	8 (2)	8 (2)
3.2 Cost of building	10%	8	8	8
3.3 Land acquirement	5%	10	8	6
3.4 Business opportunity	5%	8	10	10
<b>4. Social</b>	<b>15%</b>			
4.1 Land expropriation	3%	2 (8)	6 (4)	8 (2)
4.2 Employment opportunity after DC development	4%	8	8	10
4.3 Business opportunity after DC	4%	8	8	10



development				
4.4 Community satisfaction	1%	10	8	6
4.5 Community participation	1%	10	8	8
4.6 Life style and cultural improvement after DC development	2%	8	6	6
<b>Total (100%)</b>	<b>100%</b>	<b>6.88</b>	<b>6.64</b>	<b>6.74</b>
		<b>(1)</b>	<b>(2)</b>	<b>(3)</b>

### CONCLUSION AND RECOMMENDATION

In conclusion, it could be assumed that the Agricultural Product’s Distribution Center could support a farmer selling rice, longan, and corn with a better price due to this distribution center could save transportation cost in both inbound and outbound activities. Using a distribution method through an intermediary can reduce any incurred risks according to deterioration or variable price. This method of distribution could assist of how to move the products from the suppliers to the consumer. Having efficient road transportation in the northern part leads to the better commodity flow of rice, longan, and corn between each province; resulting in an efficient distribution. Chiangrai was found to be the first barricade to enter to the northern part of Thailand from neighbour countries such as China, Myanmar, or Laos. It is therefore reasonable for Chiangrai to develop the Agricultural Product’s Distribution Center. This center will be responsible for distributing rice, longan, and corn (or other agricultural products) in the northern part of Thailand, or any other areas especially in Bangkok.

According to the appropriate area for developing the Agricultural Product’s Distribution Center, it was summarized that a location of Chiang Khong District was the best alternative for becoming the Agricultural Product’s Distribution Center. This selected Chiang Khong location (according to technique, physical, economy, and social) was better than the location of Chiang Saen and Mae Sai, respectively. In the area of the Chiang Khong District, the construction of a new Thai-Lao bridge will be initiated and aimed at boosting trade and tourism among Thailand, Laos and China. The new bridge that links Thailand’s northern province of Chiang Rai with Laos’ Huayxai province is expected to open in 2011. The bridge will serve to link northern Thailand with Kunming, the capital of China’s Yunnan province, passing through Laos.

Furthermore, under the action plan for border area development in Chiang Rai province and in response to opportunities created by R3B highway construction and the third Thailand-Laos bridge across the Mekong River (from Chiang Khong to Huay Xai), I-EA-T was assigned to conduct a feasibility study on the establishment of an industrial estate at Chiang Khong district in Chiang Rai province. The main objectives of the construction is: 1) to determine proper roles and activities of the industrial estate at Chiang Khong district in Chiang Rai province, together with the appropriate land size that would contribute to the development of the Chiang Rai Border Economic Zone; 2) to study establishment patterns of industrial estates and/or truck terminals as well as distribution centers in terms of technical and investment issues, so that the new industrial estate could serve as a production base and logistics center; 3) to study the environmental impact via the Initial Environment Examination (IEE); 4) to study the ‘Livable Industrial Settlement’ concept of the site plan based on I-EA-T’s vision of being a pre-eminent organization dedicated to developing industrial settlements that reflect balance and sustainability in terms of economics, society, the environment and quality of life, so as to achieve competitive advantages in the global arena; and 5) to make strategic suggestions, as well as programs and projects in various areas regarding the import of international products, privileges, land-use planning, infrastructure and utilities development that would support the development of industrial estates and/or truck terminals as well as distribution center.

Therefore, establishing the Agricultural Product’s Distribution Center at Chiang Khong would aim at becoming a logistics hub to support Thailand as Indochina’s business and trade center among the GMS. This would increase cost

efficiency and customers' responsiveness of businesses and also reliability and security of their logistics process, as well as create economic value from logistics and other supporting industries.

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