An Evaluation of Distribution Center Location for Phitsanulok Province: Future of a Logistics Center in Indo-China

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Abstract
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.

Keywords: Logistics Center, Distribution Center, Phitsanulok, Indo-China Intersection
Introduction

Phitsanulok is one of the provinces located in the central part of Thailand. It has capability in business operation and competitive business advantage. Followed by an initiative of the Asian Development Bank (ADB) in supporting the development of the North-South and East-West economic corridors in Indo-China region, it is therefore essential for the Thai government in determining a strategic plan of such corridors' development to gain competitive business advantage. Phitsanulok province has an excellence infrastructure in several transportation modes such as road, rail, air, etc. and is appropriate in becoming a distribution center (DC) in Indo-China. By developing the DC, goods could be distributed to different regional parts of Thailand. A main component in developing the DC is to procure supporting area for the DC's operation. This research study has two main purposes: locating the appropriate location of a DC, and promote and increase awareness of competitive business advantage to community, farmer, and private sector.

Review of Literature

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

2.1 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 (Stevenson, 2005).

2.2 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 (Gutierrez, 2004).

2.3 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 (Stevenson, 2005).

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

Role of Distribution Center

A DC is found to be one of the most important components in logistics system. The DC can be instrumental to reduce the logistics cost and improve services. Generally, a key role that it plays is to support a movement of goods from one place to another in business activities. The followings are its important roles:
1. A DC is acting as an interchange of goods during inter-modal transshipment facility, such as transporting by a truck and changing its mode to a ship. Therefore, the DC needs to be prepared with supporting resources and equipment used for facilitating the movement of goods from one mode to another mode.

2. For consolidation facility, a DC is function as a collection center to collect goods from different locations to a customer. Transportation service provider may move goods to this DC or move goods from this DC to a customer, in order to reduce the cost due to a large amount of goods being transported.

3. A role of distribution point is opposite to the collection center. The distribution point is utilized as a center to distribute products from a supplier to other destinations. The purpose is to reduce activities and transportation cost of products.

4. Product assortment facility is a location selected for assorting products’ type from different original points to different destinations. The main objective is to reduce a number of transportation activities, and save transportation cost.

5. Storage facility is developed for the development of the DC where is located closer to an end customer. The objectives are to: storage products that are subsequently delivered to a customer, as well as decrease distance and time for transporting products.

6. Manufacturing-related services and logistics-related services are the service that gives value-added on products before sending to its destinations. Generally, the service provided in the DC includes packaging, and reassembly.

**Operation in Distribution Center**

Figure 1 illustrates the operation occurred in the DC. For its main activities, it may include warehousing, inventory control, transportation with the following key processes:

1) Receiving – receive products from a truck, then being assorted, checked, returned, and encoded.
2) Storing – store products in the DC by using material handling such as crane, conveyor belt, forklift, etc.
3) Picking – take the longest time to work on in the DC, and depends on the storage system that provides a list of items being disbursed.
4) Shipping – disbursed products being required are collected for distribution, checking, counting, and loading.

From the above processes, it can be seen that information flow and material flow are required in two directional ways. This enables effective and efficient management, planning, and controlling, or the DC activities. Some of the DCs have also implemented a barcode system or RFID system for storage management purposes. By implementing such systems, human errors can be tremendously reduced due to increasing accuracy. Furthermore, the DC management can be done through the use of "third party logistics service providers" or 3PL that plays an important role in the present time with some charges.

Methodology
Data that was collected 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 (i.e., supplier, company located in Phitsanulok, freight forwarder, agricultural, automotive, foods & beverages, textile, construction material, steel, wood, etc.), number of sampling, and method of data collection (i.e., sampling, interview). The primary data also includes current market price of land for the DC development. It was collected through the interview with landlord, natives, telephone interview, and brokers or land bureau. Lastly, this study collected data by the use of descriptive analysis according to statistical analysis such as frequency, mean, mode, and standard deviation. Furthermore, the secondary data was collected, in forms of, business type, product or service given, raw materials' source, production distribution, mode of transportation, or DC's need. All of the data were interpreted and analyzed by using descriptive statistics that were then illustrated in Table and Figure.

Criteria of Evaluating Distribution Location in Phitsanulok Province

Appropriate Area for Developing DC
Following the aforementioned concept and theory, this study did a survey and evaluated a potential location that was found to be appropriate for developing Phitsanulok's DC. Since this research study was confidential for disclosing the location data, the dummy locations were therefore assumed that are shown as follows:

(1) Location X
(2) Location Y
(3) Location Z
Fundamentally, criteria of evaluating the DC 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.

Table 1 Criteria of Weight and Score in Each Location

<table>
<thead>
<tr>
<th>Factors</th>
<th>Weight</th>
<th>X</th>
<th>Y</th>
<th>Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Technique</td>
<td>10%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1 Laws constraint</td>
<td>3</td>
<td>8</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>1.2 Layout constraint</td>
<td>2</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>1.3 Environment constraint</td>
<td>5</td>
<td>10</td>
<td>10</td>
<td>8</td>
</tr>
<tr>
<td>2. Physical</td>
<td>50%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1 Area of land</td>
<td>5</td>
<td>8</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>2.2 Shape of land</td>
<td>2</td>
<td>8</td>
<td>8</td>
<td>6</td>
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<tr>
<td>2.3 Condition of land before development</td>
<td>3</td>
<td>6</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>2.4 Facility and utility</td>
<td>10</td>
<td>4</td>
<td>8</td>
<td>10</td>
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<td>2.6 Road access</td>
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<td>10</td>
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<tr>
<td>2.7 Water access</td>
<td>3</td>
<td>6</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

Figure 2 Appropriate Location for Distribution Center Development
2.8 Rail access | 10 | 0 | 8 | 10
2.10 Air access | 5 | 0 | 0 | 10

3. Economy | 30%
3.1 Price of land | 10 | 10 | 6 | 8
3.2 Cost of building | 3 | 10 | 10 | 10
3.3 Cost of labor | 2 | 10 | 10 | 10
3.4 Land acquisition | 10 | 8 | 8 | 10
3.5 Business opportunity | 5 | 6 | 8 | 10

4. Social | 10%
4.1 Land expropriation | 2 | 10 | 10 | 6
4.2 Employment opportunity after DC development | 1 | 10 | 10 | 10
4.3 Business opportunity after DC development | 1 | 10 | 10 | 10
4.4 Community satisfaction | 3 | 8 | 8 | 8
4.5 Community participation | 2 | 2 | 2 | 2
4.7 Life style and cultural improvement after DC development | 1 | 8 | 8 | 10

| Total (100%) | 100% | 65.8 | 74.2 | 89.8 |

In summary, the study presented here indicated that location Z is the best alternative for becoming the Phitsanulok's DC due to the total score of technique, physical, economy, social factors being weighted. The total score of location Z was higher than those of location Y and X, respectively.

References


Sustainable Infrastructure Research and Development Center, Faculty of Engineering, Khon-Kaen University (2005). A Project Study of Inland Container Depot, ICD by Railway, Khon-Kaen Province.