Infrastructure and Layout Design for Phitsanulok’s Logistics Center:  
the Junction of North-South and East-West Economics Corridor

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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 at 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) designing infrastructure and layout of the distribution center for Phitsanulok and 2) reviewing a plan covering both short-term and long-term used for developing the distribution center.

Key Words: Phitsanulok, Logistics Center, Distribution Center, Indo-China

1. Introduction

Thailand has played a key role and is aimed at becoming the hub of transportation in the Greater Mekong Sub-region (GMS) by 2006. In order to accomplish this ultimate goal, 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 a transportation hub and a distribution center in the GMS. 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.

In considering the cluster of both Phitsanulok and nearby provinces in becoming logistics centers in Indo-China, the team project 1) gathered data from several public and
private organizations, 2) interviewed organizations involved, 3) formulated focus groups with entrepreneurship in nearby areas, and 4) conducted surveys by using questionnaires. Afterward, the project team took the collected data for further analysis and drew a reasonable conclusion, as well as proposed a development plan that is illustrated in the following phases to be included in the Phitsanulok’s logistics center.

- Phase 1 (2005 and beyond), establishing the distribution center (DC)
- Phase 2 (2007 – 2017), developing multimodal transportation continued from establishing the DC

2. Review of Literature

2.1 Definition

Plant layout

Physical layout is an important element that embraces operation cards, inventory control, material handling, scheduling, routing, and dispatching. Its objective is to develop a production system that permits the manufacture of the desired number of products with the desired quality at the least cost [4].

Logistics center

A center for logistics plan, implementation, and control the efficient, effective forward and reverse flow and storage of goods, services, and related information between the point of original and the point of consumption in order to meet customers’ requirements [5].

Distribution center

Distribution center is a modern warehouse that processes inventory based upon the direction of the corporate systems [5].

2.2 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 worldclass transportation system with worldclass 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.

The above two literatures related to logistics/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/distribution center located in Korea and Singapore may be exemplary for Thailand.

3. Conceptual Design of Distribution Center

Establishing the DC can start immediately because the appropriate geographical location of Phitsanulok is at the intersection between the North-South and East-West Economic Corridors. It is also due to the need of utilizing the DC by private sectors, and the problem of a continuous rise of oil prices. Nonetheless, private sectors have operated this own DCs in collaboration with their own transportation systems (around 60 – 80 percent) and own warehouses (around 90 – 100 percent). The potential customers for this DC are local private companies or other domestic/foreign customers. According to initial investment, Thai government also subsidies the DC in initial stages by providing land and share the cost of construction development. The size of a private DC can vary according to the size of an individual business, and the private DCs that are scattered in different locations in Phitsanulok. This results in higher distribution and service costs which can be observed by the questionnaires investigating the total logistics cost. The total logistics cost in Thailand is approximately 15 – 30% of overall sale (Center for Logistics Research, 2005). When forecasting demand in the next five years of the need for distribution and service systems in Phitsanulok, and its cluster of the lower part of the North, it is found that economic growth in this area is prosperous with a fast pace. The Thai government has set a fair policy to sustain and stimulate economic growth, and has encouraged economic cooperation in the GMS. Such initiatives have let all allied countries in the GMS stand together.

4. Process of Designing Distribution Center’s Layout

Figure 1 illustrates a process of designing the DC according to a concept of Richard Muther (1970). Muther developed the design process that should begin with determining volume and characteristic of products to be stored. Then, activities that are occurred in the DC and its relationship should be defined in order to develop a relationship diagram. After that, space relationship diagram will be determined in order to identify an actual space of the above activities used in the DC. Next step, modifying of the layout can be done along with assuming practical limitations whereas alternatives layout may be proposed and developed and evaluation. In the last step, such design will be evaluated and may be adjusted accordingly.
4.1 Activity Relationships Diagram

By using activity relationship diagram, a visual presentation of the different activities is drawn. An analysis starts with the absolutely important relationship (A’s), then proceeds to the E’s, and continues for the I’s, O’s, and U’s [4].

Figure 2 Activity Relationships Diagram for Distribution Center

4.2 Space Relationship Layout

A spatial representation is developed by scaling the areas in terms of relative size. Once an analysis is satisfied with layout, the areas are compressed into a floor plan. Although some of modifications may be needed, they should be made to layout based on material handling requirements, storage facilities, personnel requirements, building features, and utilities [4].
4.3 Layout of Distribution Center

The Phitsanulok’s DC is located at Kilometer 12 on highway no. 12 with a total area of 128,000 meter square. It is far from the Phitsanulok airport approximately 2 kilometers. The DC may contain several warehouse or container yard. Figure 4 illustrates the layout that contains SMEs/OTOP storage warehouse, agricultural warehouse, container freight building, container yard, and other warehouses.

This research study uses the layout by assuming the size of each building. The agricultural warehouse has an area of 9,000 meter square, 8 meter height, along with 8 truck dockings and 6 warehouse doors. Inside is spatial that is used for agricultural product storage and for general office. Furthermore, the SMEs/OTOP warehouse is designed to locate within the same building with a total area of 9,000 meter square, 8 meter height, along with 8 truck dockings and 6 warehouse doors. Internal space used for storing SMEs product is 6,720 meter square, and for storing OTOP product is 2,400 meter square. Receiving and packaging areas for both products are similar. A container yard (CY) is used for storing a 20 or 40 feet container with a total area of 38,950 meter square. Other infrastructures located nearby this DC include: Phitsanulok’s airport, railway station, truck terminal, and private owned factories. The benefits of developing this DC are: linking factories to wholesalers, retailers, or end customers, and instrumental to multimodal transport (i.e., road and rail).
According to transportation, transporting goods with “less than a full truckload” may result in higher costs of good sold (as per a unit price increment). A distribution center will therefore be instrumental in reducing the cost of goods sold. In this case, there should be “circle links” in each part of Thailand (i.e., Phitsanulok, Khonkaen, Laemchabang, Chonburi, and Ranong). This would allow goods to be distributed to four different parts of Thailand, which would reduce costs in transporting goods either inside or outside the country.

5. Investment and Operation in Phitsanulok’s Distribution Center

5.1 Short-Term Plan

The Short-Term Plan consists of building two warehouses, and an empty area for container storages (illustrated in Figure 6).

5.2 Long-Term Plan

The Long-Term Plan consists of building selection and packaging buildings of products in which the products are moved with a container or moved to and from warehouses (illustrated in Figure 7).
5.3 Investment and Return

Investing in this DC project may include an investment of three warehouses (i.e., agricultural warehouse, industrial warehouse, OTOP/SMEs warehouse), and container yard. An initial investment is approximately 100 million baht by loaning from Financial Institute approximately 530 million baht. Land in this DC used is around 100 Rai with an investment of 507.56 million baht. Nearby areas around the DC includes road, waste management system, utility and facility systems. Additionally, this DC may include material handlings such as lift truck, conveyor belt, stacker, etc.

<table>
<thead>
<tr>
<th>Investment Capital</th>
<th>507.56 Million Baht</th>
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<tr>
<td>Return Period</td>
<td>8 Years</td>
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<tr>
<td>Ratio of Return of Investment in 10 Years</td>
<td>10 Percents</td>
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</tbody>
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6. Conclusion and Recommendation

In summary, Phitsanulok province is thought to be more appropriate in becoming a distribution center (DC) in Indo-China. It also has an excellence infrastructure as well as is located at the intersection between the North-South and East-West Economic Corridors (Indo-China Intersection). According to the Logistics Master Plan developed by the Office of National Economic and Social Development Plan, Phitsanulok has been selected to be a Logistics Center of Indo-China Intersection. Therefore, this study collected data and proposed a development plan with four phases: Phase 1 (2005 and beyond), establishing the DC, and Phase 2 (2007 – 2017), developing multimodal transportation. In the first phase, the DC was studied and its layout was designed accordingly the concept of Muther’s activity relationships diagram and space relationship layout. This study evaluated the Phitsanulok’s DC layout and proposed that the DC should contain SMEs/OTOP storage warehouse, agricultural warehouse, container freight building, container yard, and other warehouses. The short-term plan consists of building two warehouses, and an empty area for container storages, and the long-term plan consists of building selection and packaging buildings of products, with the investment capital of 507.56 million baht, return period of 8 years, and ratio of return of investment in 10 years of 10 percents.

References