CHAPTER 2

THEORIES RELATED TO RESEARCH

This chapter consists of five parts. The first section is literature survey. The second part is theory consideration. The third section is decision support system. The fourth section is database systems and the last one is data concept. All the reviewed items are needed in making decision for plant location selection.

2.1 LITERATURE SURVEY

These researches support us to know the number of any factors that influence business owner in making decision for plant location selection. They also allow us to understand and develop our research by using factors related to making decision for plant location selection and questionnaires as a guideline for us to set the question to ask business owners. The details in each item help us understand clearly the relative priority of the important factors. Kasemsak Mitarakasem[2] studied on the application of the Analytic Hierarchy Process for selection plant location in sorbitol factory case study depends on a number of factors and tradeoffs among benefits and costs. The criteria for plant location selection were divided into tangible and intangible factors. The tangible factors were composed of raw material reliability, service and facility availability, labour availability, community attitude, market advantages and land use advantage. He found that the application of AHP in plant location selection helps the decision makers to distinguish clearly the priority of each factors for plant location selection. Similarly, Prapasri Swadi-ampairaks[3] studied on selection of factory location by using multi-criteria decision-making in case of packaging firm by using Analytical Hierarchy (AHP). She studied any factors that affect to the site selection and the decision criteria. This research found that the main factors are land cost, transportation cost, plant construction cost,

market infrastructure, working environment, community or society and state supports. The primary choices are suitable to plant location selection consist of Bangpoo Industrial Estate, Navanakorn Industrial Estate, Bang pa-in Industrial Estate and Hi-Tech Industrial Estate.

Putoompom Jewrasumneay [4] studied on the major factors influencing location of industry in Phra Khonong district. It focused on any factors including transportation, labour, infrastructure, finance, market, raw materials, and land prices, old businesses specializing in the same product. After that she found that transportation cost is the first factor that most people would like to considering in plant location in Phra Khonong district, market cost as the second, raw material supply cost as the thirth, labour as the fourth and land prices as the fifth. Jinda Chobpattana[5] studied on the location factors influencing the site selection of manufacturing industrial in Bangkok Metropolitan Region. It consisted of six provinces, Bangkok, Samut Prakan, Samut Sakhon Pathum Thani, Nakhon Patthom, Nontha Buri and Pathum Thani. She used the shift share analysis that showed the higher growth rate might stem from better facilities for transportation and communication. This research found that the hypothesized factors were land cost, agglomeration economics, market characteristics and accessibility of transportation.

Gishlick[6] studied what factors that influencing in manufacturing plant location. He eliminated that factors from a questionnaire survey such as distance to the nearest interstate highway, site size, community population, average wage in the area, sewer, barge and railroad potentials, tax rate, transportation cost, distance to the nearest airport and educational expenditures per capital. The result of this research found any factors that related to plant location selection as following as, access to interstate highways, access to commercial airports and the presence of sewer systems in the site. Chantana Sthoop[7] focused on location, distribution and numbers of manufacturing firms including of factor influencing for industry growth in the Rat Burana district. After that she found that transporation cost is the main factor influencing the location factor about 90 percent in Rat Burana district. Other supporting factors consist of the source of raw materials, public health or public

service and finance market. Hoover[8] developed the concepts of industrial location selection by considering in factors that make gain competitive advantage, raw material and cost. After developed, he found that cost of transportation is main factor to increase good price for manufacturing for plant location selection.

Kanchani Pongchan[9] studied on location theory that analysis and explains the concepts on selection of optimum location of economic units. After the research, she found that the best location should use the theory of the maximum profit location. The best location should considering in the area development and social welfare. This research found that the most popular plant location theory in Thailand is the least cost location theory. These researches provide information for location theory that enhances us to know and understand about location theory and number of location theory detail that used in currency for plant location selection.

Surang Likitaroonrat[10] helps us to clearly understand decision support system and support us to bring its knowledge to develop our research later. She studied a decision support system for selection of statistical forecasting techniques corresponding to user's data patterns, characteristically-reasons and purposed. Nissara Bunsook[11] developed a decision support system for parts purchasing. It allows us to understand the decision support system process and its advantage. The decision support system helped her to quickly process and provide quality of purchase parts closed to the used parts, and help users to decrease inventory cost.

There are several researches and books that focused on plant location selection because plant location is more important for business owners, manufacturing, and business operation to gain high business profit and survive in the long term. The problem of location selection occurs when a new plant is to be established or expanded at the poor location from first day of manufacturing operation. The poor location will make high costs in business operation, production process and make mistake for developing or improving the business operation in the future. However, we would like to develop the decision support system for plant location selection in both industries, concrete

industry and plastic industry allow business owners or person in related positions as a guideline for them in making decision for plant location selection.

2.2 THEORY CONSIDERATION

2.2.1 Theory of Least-Cost location model[12]

The least-cost location theory has originated by Von Thunen (1875) and Alfred Weber (1909) for the site offering at the least cost sites and assumes that the plant location selection has no influence on the demand for the product and the market area. It also disregards the location interdependence of competing companies.

2.2.2 Location Cost-Volume Analysis[13]

Location cost-volume analysis using economic comparison of location alternatives. This method can be classified into three steps. First step, design the fixed costs and the variable costs with each individual location alternative.

Second, plot the total cost lines for all location alternatives on the same graph.

Third, identify the range of output for each location alternative and then, design the location that has the lowest total cost for the expected level of output.

2.2.3 The Theory of the Maximum-Profit location[13]

The maximum-profit location was proposed by August Losch for plant location selection depend on the company's cost of production at alternative locations in the market area which it is able to control from each site. Greenhut has proposes a general theory of plant location that considers in total cost, total revenues, the sale radius and the maximum-

profit. This theory will be considered of the factor based on total cost and total revenues such as the costs of transporting products from the factory to the market location, and labour cost.

2.2.4 Location Factor Rating Evaluation [13]

Location factor rating is commonly used help in plant location selection from many types of information and data inputs. It is benefit both for evaluate a given alternative and for compare alternatives. This technique that help us to compare from one location to other location by using factors. This model is popular techniques that used to find the suitable plant location. It used to evaluate from any factor information requirement. In location factor rating, factors are important for make decision in plant location selection.

This technique is process when each factor of individual location is evaluated such as market location, water supply, labour supply, construction cost, and then the weights are assigned to each factor depend on manufacturer's requirement and its relative importance compared to all other factors.

Each individual location score was rated from 0 to 100 with regard its importance, it's depend on its attractiveness from one location compared to other location. The factor has more attractive or important that was assigned in the highest amount. And some factor has less important or attractive when compare to each of factor that may be eliminates or assigned at the low amount. Each plant location factor is weighted from 0 to 1 to prioritize the factor and reflect its importance.

The weight scores for each location are computed by multiplying the factor weights by the score for the factor. After that, the weight scores will collect and the total scores for each location are summarized. We can choose the best location with the highest score. This

technique helps us to know the best factor rating compared to other location to help us in making decision for plant location selection.

The mathematical expression can be stated as:

$$X_j = \sum_{i=1}^{n} w_i x_{ij}$$

Where

i = location factor number

j = candidate location number

n = number of candidate location

w_i = weight assigned to factor i

x_{ij} = rank/score assigned to factor i for location j, and

X_j = suitability index calculated for location j.

The best plant location selection is candidate j such that Max $[X_j]$

2.2.5 Shift Share Analysis[13]

The shift share analysis was developed by Daniel Creammer, but it become well know after Harvey S Perloff, Edgar S. Dunn, Erice Lampard, and Richard F. Luth represented a major tool of analysis in their book.

These methods identify the factors, which contribute to regional economic growth. The factor was separate into three parts, regional share, proportional shift, and differential shift.

2.1.5.1 Regional Share

Regional share effect is defined as the amount of value added in a region if the regional production could increase exactly at the same rate as the national production. The measurement will provide an analysis of regional contribution to the national growth.

2.1.5.2 Proportional shift

Proportional shift is defined as the amount of the growth of the regional production deviated from the rate of growth of the national production. The measurement will provide an analysis of the impact of industrial structure on regional growth. It will show the specialized industry can help accelerate regional growth.

2.1.5.3 Differential shift

Differential shift is defined as the sector, which accounts for other remaining factors affecting a region's industry growth. If a sector expands more rapidly in one region than it does in other regions, the former will experience a positive value of regional share, and if the opposite occurs, it is a negative value.

The technique of shift share analysis is a simple method that adequately copes with both the spatial and industrial changes that have taken place within an economy. It shows the relationships between the growth of a region's industries and overall national growth.

2.2.6 Location Quotient[14]

The location quotient was represented by Walter Isard that is a statistical measurement, which explain both in the degree of specialization and concentration of activity in an area.

$$L.Q. = \frac{X^r_i / X^r}{X^c_i / X^c}$$

Where,

L.Q.	=	Location quotient
X^r_i	=	The value of the regional experimental variable
X^r	=	The value of the regional referent variable
X^c_i	=	The national experimental value
X^c	=	The value of the national referent variable

2.2.7 Distance or Frequency Analysis[13]

This method used to be comparing the shipping costs related to the use of each location. It easily to used shipping distances if they are proportional to the costs. There are two major costs of the shipping cost of raw materials and the shipping costs of finished goods.

2.2.8 Center-of-Gravity Technique[15]

This technique is suitable for warehouse facilities that locate at the center of movement in a geographic area based on weight and distance. This method identifies a set of coordinates designating a central location on the map relative to all other locations. It used grid map coordinates that set up on a Cartesian plane.

The mathematical expression can be stated as:

$$X = \frac{\sum_{i=A}^{D} x_i W_i}{\sum_{i=A}^{D} W_i}$$

Where

x,y = coordinates of the new facility at center of gravity

x_i,y_i = coordinates of existing facility I

W_i = annual weight shipped from facility i

2.3 DECISION SUPPORT SYSTEMS

"Decision support systems (DSSs) are computer-based information systems designed to help managers or users to select one of many alternate solutions to a problem, and to help corporations increase market share, reduce costs, increase profitability, and enhance product quality.[16]

"Decision support systems can be viewed as a third generation of computer based applications. First, mainframe computers were used mostly for transactions processing. Then, there was a growing realization that computers and information technology could be used for purposes other than automating paper work."[17]

The objective of decision support systems is to provide information and decision support techniques needed to solve specific problems.

Decision support systems consist of: analytical models, specialized databases, a decision-maker's own insights and decisions, and an interactive by using computer based modeling process to support decision making of semi-structure or structure decision by each individual users.

2.3.1 Decision Support Systems Components

Decision support systems consist of the data management module, the model management module and the dialog management module. This module help users to enter a demand or ask the question in a convenient form, easily and quickly access or search the huge amounts of information, use the information in desired models and show or present the result in one or several answer for easy users to making decision.

2.3.1.1 Data management module

The data management module is the database system, including any information in a particular order. The user can access, edit, change or add some data directly and easily.

2.3.1.2 The model management module

The model management module is system that consist of decision model that help user make decision, find the result and select the suitable way by using the database. The model was considered from among its inputs, outputs and any conditions that enough to analyze. The models used to forecast output depend on different input or different conditions.

2.3.1.3 The dialog management module

The dialog management module is user interface. This part allows user to access the database and select the related data for the decision process. This system has to provide easily way to interact between user and the computer program or decision support systems. It may be consist of various texts, tabular, and graphical displays that help user to choose and make decision easily and attractively. It will provide several form of commands, pull down menus, icons, dialog boxes, graphical display or any other function on the display screen for each individual users can choose. It helps users to make decision for each individual user.

2.3.2 Decision support systems in plant location selection.

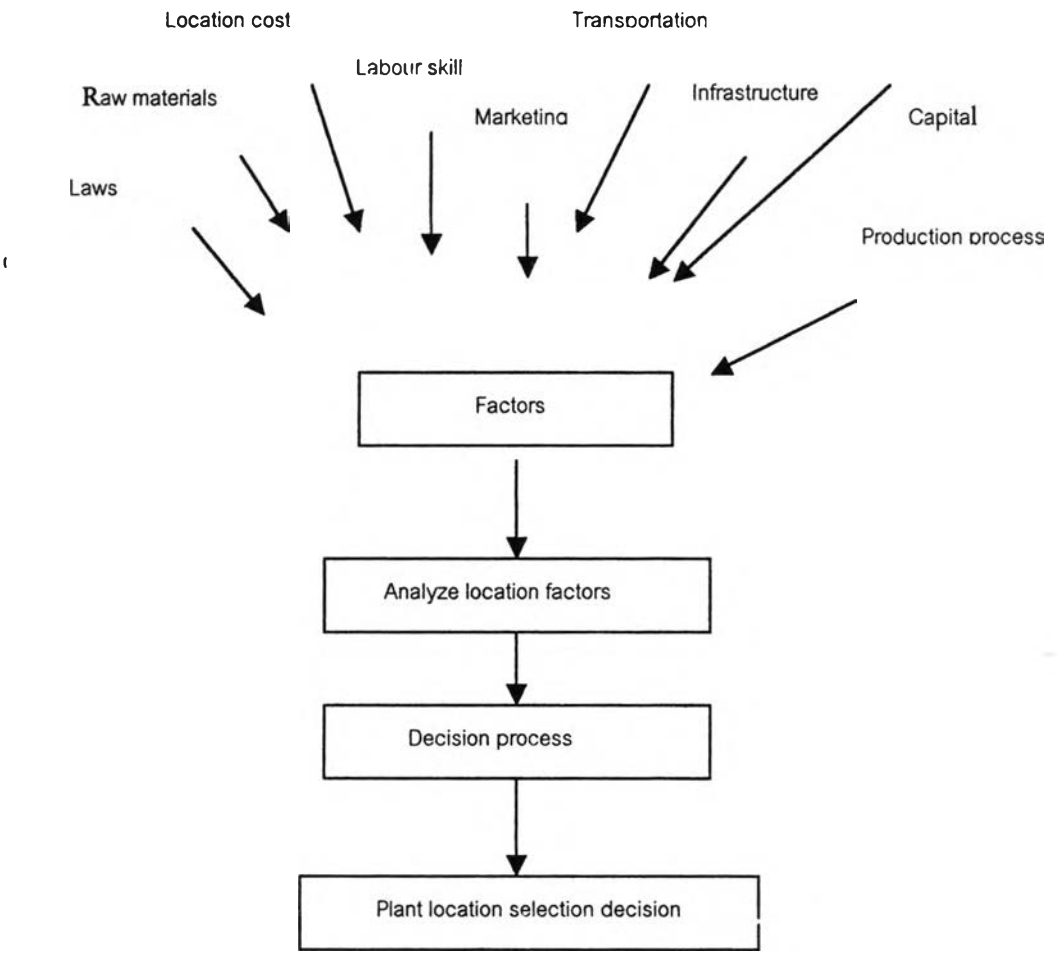

Figure 2.1: Decision support systems for plant location selection.

2.3.3 Advantage of using decisions support system.

- To provide information and decision support techniques to help users to solve problem or decision making.
- To support users including intelligence, design, choice, and implement of decision-making.
- To direct support the decision making for each individual users.

2.4 DATABASE SYSTEM

Database is a standard technique for managing the data and collecting the data in most organization. Database system consists of both of database and database management system.

2.4.1 Database

"Database is a shared collection of logically related data, designed to meet the information needs of multiple users in an organization"[18]

2.4.2 Advantage of database

- To allow users to sharing the data, it means that data required need to be stored only once.
- To help users to develop a well-designed database, a flexible database better than separates files
- To allow users to access or used the data by themselves.
- To reduce data redundancy and inconsistency.
-

2.4.3 Disadvantage of database

- The data are not security cause all of data are collected in one place.

2.4.4 Database Management System (DBMS)

"A database management system (DBMS) is software system that helps manage disk-based data and it collects and structures related files so that many users can easily retrieve, manipulate, and store data"[16]

Database management system allows users to create, modify, update, retrieve of database and linking the data for application programs.

2.4.5 Advantage of database management system

- To allow users to sharing the data cause of database management systems is provided centralize the data.
- To reduce data redundancy and inconsistency.
- To allow users to access , used and retrieve the data in many ways
- To provide the data security cause of DBMS including a password that controls other user to access data from the system
- To help users to changes repairs and maintenance the system easily.
- To provide special information, it can produce reports with the minimum effort.

2.4.6 Disadvantage of database management system

- To expensive, DBMS require users to purchase of additional memory, disk drive and DBMS software. And some worker who is unfamiliar with DBMS concepts that will need special training to understand DBMS.

2.5 DATA CONCEPT

The data concept help users to understand how data are represented before consideration the use of files or the database advance.

2.5.1 Entities: Entity is any object or event that a user chooses to collect the data. Entities may be a person, place or thing.

2.5.2 Relationships: Relationships are associations between entities. There are three types of relationships.

2.5.2.1 One-to-one relationship

Figure 2.2 : One-to-one relationships.

It shows that one employee has only office.

2.5.2.2 One-to-many relationship and Many to one relationship

Figure 2.3: One-to-many relationships.

It shows that one doctor can health-maintenance to many patient.

2.5.2.3 Many-to-many relationship

Figure 2.4: Many-to-many relationships.

It shows that a student can take several courses in one semester.

2.5.3 Attributes: Attributes is some characteristic of entity. It can be many attributes for each entity. For example, employee (entity) can have many attributes, such as first name, last name, address, telephone, salary, and so on.

2.5.4 Records: Record is a collection of data items.

2.5.5 Keys: Key is one data items in a record that is used to identify the record. It will classify into primary key, secondary key and so on. The primary key is unique key that identifies a record.

2.5.6 Relational database: Relational database is the data sets order data in a table of rows and columns. The table's row called tuples, it is collect the record. The table's column collects fields or attributes.

2.5.7 Domain is the set of data in each attribute.

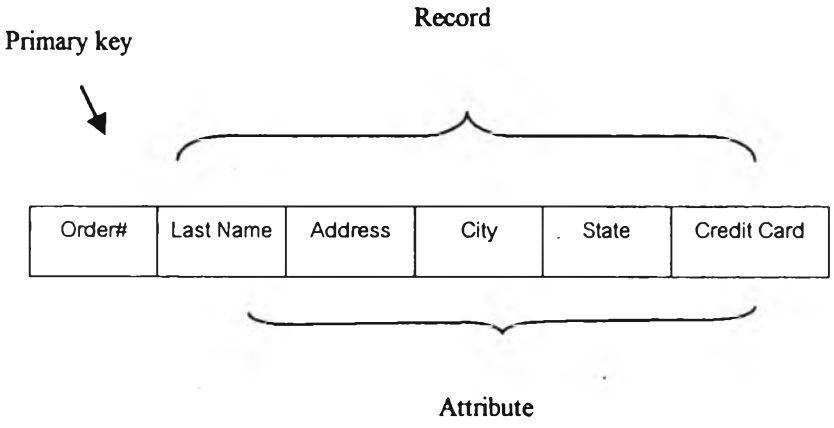

Figure 2.5: A record that has a primary key and may have many attributes.

2.6 Data Flow Diagram

" The data flow diagram (DFD) is a graphic model of the flow, use, and transformation of data through a set of processes. The diagram shows the external agents that are the sources or destinations of data, the processes that transform (or act on) the data, and the data stores where data are collected and held."[18]