A Decision Tree-Based Two-way Approach to Location Planning: An Empirical Model for the Shopping Centers in Thailand

by

Mr. Charnwit Somprakij

A Doctoral Dissertation

Submitted in Partial Fulfillment
of the Requirements for the Degree of
Doctor of Philosophy
in
Computer and Engineering Management
Assumption University

November 2005

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Dissertation

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ABSTRACT

This research aims to complete a managing facility network data model, which is the location data in Thailand for the best location. It relies on completeness of location factors, accuracy and availability of location data. Data is exhaustively searched through publicly available sources, including private, governmental and non-governmental organizations. Location information is collected from websites of all ministries in Thailand. Completeness of location factors for a thorough site investigation is assured by supplementing the obtained web data with published information from research and business literature. The model is applied by using bottom-up and top-down approach for decision making, and developing urban planning.

The preliminary investigation identified 228 location factors that are generally applicable to any industry. Among these, 95 factors applicable to retail location analysis are identified and evaluated for relevancy through expert opinions. Factors are ranked in order of importance by means. The taxonomy of retail location factors can be used and applied into many industries. They are subsequently extracted into homogeneous groups via principal component analysis. A structural equation model of retail location factors is developed and validated by the confirmatory factor analysis. Proposed methodology can reduce an initial list of location factors to 4 significant groups of 32 retail location factors. Analysis of the 4 resultant factor groups reveals that they may be categorized into location-specific and non-location-specific retail location factors. The research findings apparently indicate that both categories of factor groups are vital to location decisions. This can explain why a retailer fails and the other succeeds even though their locations are nearby.

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I. INTRODUCTION

1.1 Background of the Event

Within the range of business decisions that must be made by both local and foreign investors, site location represents an issue of high priority. This is due to the fact that site selection can affect the long-term profitability of the firm.

The researcher conducted interviews directly with governmental organizations and found that the location decision for factories was more often than not very unsystematically organized. Although the officers in charge of the decision were in possession of survey information, the data were usually redundant, dispersed, or insufficient relevance to applications within public service; worse was the unclear information and unclassified factors. A single comprehensive source of location data is usually nonexistent, thus necessitating a laborious, time-consuming site search. The major problems are a lack of knowledge and an insufficient information support system for all concerned properties, which means that people who have a solid knowledge of facility planning are still confronted by obstacles to accurate information. Organizations whose employees have no knowledge of facility location management and do not recognize its significance to other areas in the business also contribute to those businesses going bankrupt. From a micro perspective, many organizations attempt to classify and manage land with zoning, such as industrial parks development. However, the suitability of land for a certain purpose depends on a range of factors (not just one or two), which makes it beneficial to find out what the actual causes of investment failures are. The issues of having inadequate information and the lack of knowledge for some organization officials should be looked at from both the investors' viewpoint and through the entire macro system as a city plan.

Having a viable city plan should be considered the first priority in developing a metropolitan. In the planning stage, many location factors are interrelated and because the relationships among them are relatively complicated, the city has to carefully lay out the city in order to avoid any major problems in the future. Because the government does not clearly define the roles of each department with regards to land use, investors run into a lot of problems in locating the necessary data. For example, they may look to the Board of Investment in regards information on investing in a factory or go to the Ministry of Interior for data on land, water and electricity infrastructure, which leads to a time-consuming period of data gathering. This means that Thailand may miss several opportunities for foreign investment, as investigating and researching investment opportunities are difficult and the government does not seem to care or pay much attention.

It can be seen that the Thai government has not recognized the benefits and value of an effective information system able to support both the public and private sectors. A reform was only started in late 2001 when Prime Minister Thaksin was elected, with the cabinet creating an amendment entitled, "The Amending Ministry, Sub-ministry and Department Act B.E.2545." This amendment created a significant impact, pushing the creation of an information system that was able to support numerous objectives. The Ministry of Information and Communication Technology (ICT) then became responsible for developing and standardizing the system for each of the ministries.

1.2 Significance of the Study

In the past, when information with regards to the investment process was needed, the researcher attempted to communicate with many departments to corroborate public information. The data gathered from the many departments were, however, usually redundant and dispersed, with the departments themselves lacking clearly defined responsibilities and insufficient information. The incident prompted the researcher to investigate land information, starting with the question "Which factors affect land use?" Then the researcher began listing as many factors as possible, analyzing each of the factors in order to minimize redundancy and to clearly identify the meaning of each factor. In addition, a decision tree model was used to manage the facility network data and solve problems because it was a systematic and efficient way to analyze facility factors in each investment objective, with the model able to express details, the frequency of use, the classification of factors in multi-level responses of information, and analyses of each factor to generate facility location equations.

This research concentrates on how users – defined as organizations, investors, and governmental bodies – use information for land-use planning, with separate viewpoints on the micro and macro levels. Within the micro level, individuals or groups of people (such as those that make up an organization) are considered. If the participants follow the study, the budget and time of investment can be drastically reduced, especially once it is widely applied at the macro level. It is not only limited to land use, either, but can be employed in any other area involving land use and the utilization of an information system for such data. In this way, this research could be a very significant part in the education of network land use and future urban planning.

1.3 Originality

Years ago, the government had to tackle the problem of solving and settling the budgets of repairing various infrastructures in the urban area. The reconstruction has affected citizens both directly and indirectly: land is expropriated from the people (direct) and everyone has to find a way to deal with the pollution that occurs from the reconstruction (indirect). The effects occur from a lack of data when land planning, so it is an on-going endeavor to solve those problems. Within the literature of land use, many articles, researches, journals, papers, and statistics on the design, application, theoretical performance, resources, and models in land planning exist. There are no land use planning models for local and international information that is complete and systematic in structure, with multi-level processes that are based on primary and secondary data and applications in any business sector. Therefore, this dissertation can be considered part of the fulfillment of "The Amending Ministry, Sub-ministry and Department Act B.E.2545" act in 2003, which supports the creation of a land use information system.

1.4 Objectives of the Study

While there are insufficient data to support users such as organizations, researchers, and governmental bodies, the country itself goes on developing. In order to solve this problem, the government must be involved in organizing the data into a more efficient and effective system than in the present manner. The researcher has attempted to analyze comprehensive location factors for a shopping center, grouping them through the use of factor analysis. The analysis can be developed further to become a source of data to support future publications. These sources can be classified into both primary and secondary sources, with primary source information coming from survey instruments and secondary source information coming from research through existing data, such as those in the databases of the government, the private sector, and NGOs. When investors can receive enough supporting information to support their decisions, less time is wasted. The objectives of the study are as follows:

(1) To propose a systematic method in managing data for location and urban planning

(2) To propose a two-way approach in establishing a comprehensive location database

(3) To group location factors by factor analysis in the retail industry

(4) To find out the relationships among location factors for shopping centers in the Bangkok area

(5) To formulate an appropriate mathematical model for the shopping center site selection

This research proposes the formula of using a decision tree-based approach in order to classify shopping centers, with the model having steps involved for managing data in order to support location and urban planning, through a systematic collection and manipulation of location data so as to guarantee the best urban development plans. In addition, the two-way, bottom-up and top-down approaches are applied in the establishment of a comprehensive location database. The preliminary bottom-up stage would be an attempt to exhaustively collect location factors from the public and private sectors, as well as from non-governmental organizations (NGOs), with direct contacts and searches through publicly available websites published by these sources in Thailand resulting in a sizable initial list of location-related data. The top-down stage would be a supplementation of the preliminary list with location factors taken from a thorough literature review. The combined list would then be examined for the applicability and relevance to the shopping center location decision.

Therefore, this paper results in a further enhancement of the process of planning, analyzing, and managing shopping center locations, which would lead the academic community as well as the private and government sectors to make an effort to develop effective criteria to use in facilities location analyses. With several adjustments, the process may also be applicable to other industries as well.

In the following sections, chapter II will detail the literature review. Chapter III will present the research methodology. Data analysis will be interpreted and described in chapter IV. Conclusion and Recommendation will be discussed in chapter V.

II. LITERATURE REVIEW

2.1 Background of Location Problems

In the traditional economic view, theories pinpoint the business as an optimizing entity that selects a particular location in order to achieve profit maximization. Simplistic though this view may be, it still has proven to be an extremely useful concept in understanding the behavior of business location. The issue of location has been studied for a long time, with such people as Weber (1929), Hoover (1948), and Lösch (1967), being associated with its development.

Facility location is an issue that concerns both commercial organizations and governments. Issues with regards to facility location include the environmental damage and congestion caused by transportation networks, as researched by Davies (1984), as well as the continuity of activities and a satisfactorily high level of sales or profit for retail and bank institutes, as researched by Ghosh and McLafferty (1987), Wrigley (1988), and Davies and Rogers (1984). Leonardi (1981) focused his research extensively on particular facility types. His findings are summarized in the following list:

(1) The needs and demands of consumers are satisfied by facility locations, whereas in delivery systems, goods and services are delivered to these locations of demand by the suppliers.

(2) Another type of system exists, called destination location. An example may be certain school systems where the local government or planning agency allocates students to the various schools.

(3) Transportation costs from establishing facilities are paid by the public or private decision makers.

Because the geographic location is important to achieving the decision maker's goals, having a facility location relative to consumers determines, to some extent, the benefit that consumers derive from it as well as the economic performance of the facilities and the amount of traffic generated therein by the system. In their research on the importance of quality of life in deciding the location of economy firms, Salvesen and Renski (2003) found that in addition to accessibility, economic performance further depended on the relativity of the facility location to competitors, as well as various site-specific characteristics. Various objectives accompany the decision of locating facility networks to serve the population in a certain geographic area. In general, a commercial planner may want to maximize profits or market share while a governmental planner would aim to create a high level of service for the population. In all instances, the facility network performance depends on its location relative to that of the consumer population it serves. Allocation problems are defined according to two basic elements according to Arentze (2000):

(1) Determining facility locations.

(2) Allocating consumers to facilities, so as to evaluate the system performance.

The objective of a location-search problem is, in general, to find locations that optimize various factors, including the minimization of total cost and the maximization of proximity to certain facilities (Arentze et al, 1996; Malczewski, 1992). There are numerous case studies with regards to the location or site-search problem (Baerwald, 1981; Gilbert et al, 1985; Lane and McDonald, 1983; Minor and Jacobs, 1994). An evolutionary approach that addressed multiple objectives (such as cost and proximity) through the use of an undirected graph and a set of operations was described by Xiao et al. (2002). The approach was designed to manipulate the location and shape of facilities during the search in order to come up with possible solutions.

An example of a location search would be the location of a site for new residences, wherein the investors would like the sites to be located close to facilities such as transportation and shopping centers but at the same time would like to minimize the cost of construction as well. The challenge here is to construct a model or apply an approach that ultimately gives the most feasible solutions. While Gilbert et al (1985) employed an implicit enumeration strategy for this. Cova and Church (2000a; 2000b) recently devised an explicit method that analytically transferred the contiguity requirements of the problem into constraints where optimization techniques could be applied. In the method of Cova and Church (2000a), non-compact shapes may be overlooked when enumeration approaches are used, and computational difficulties could be encountered – especially when multi-objective, nonlinear, large problems are involved. An evolutionary algorithm approach to these site-search problems was described by Brookes (1998; 2001): a seed cell is selected before being grown into a region (Brookes, 1997), controlled by region-growing algorithms used to guide the growth process that included parameters for location, size, orientation, and number of arms. A site or region is evaluated based on its underlying suitability and shape, where a trade-off value is used to convert the two objectives into a single value that is used in conjunction with the parameters to form a solution that evolutionary operations can be applied, in order to search for a site. Effective though this approach may be, certain shapes may not be fully defined using the parameters set. Also, combining the shape and compactness of a solution into a single value through the use of a trade-off, or weighting scheme, could easily result in the preclusion of certain solutions. Although Cova and Church (2000) considered shape and compactness to be constraints, they are not necessarily the true goals to be optimized – they are, instead, conditions that are used in controlling the search.

2.2 The Industrial Site Selection Process

Theoretical models of facility location do not truly capture what is involved when real businesses make decisions on locations, as they are a simplication of reality. The applicability of models depends on the validity of their simplified assumptions. For example, profit maximization models generally make the assumption that companies are rational and economic entities that operate in a perfectly competitive and informed environment. In reality, location decisions are usually not entirely rational, where information is imperfect and costly. Strategic bargaining between large organizations and the local government can include or exclude certain site options. Theoretical models do not reveal much about the location decision-making process itself, which is a crucial part of information for policy makers who would like to take proactive roles in their community development.

Relocation and expansion are major decisions for businesses, and Blair and Premus (1987) and Cohen (2000) suggested strategic decision-making processes for relocation and expansion that was part of a larger corporate planning process. It is considerably expensive and risky to plan, build, and operate at new locations, where redistribution and dedication of existing resources must occur. The risk and cost involved tend to encourage many firms to expand at or near the existing site, unless certain problems make local expansion or continuing operations at that particular site unacceptable.

Lacking sufficient information, many businesses pursue formal site selection by examining and evaluating site options with a limited set of criteria. Although many companies hire experts to help find suitable locations for facilities, most often companies make decisions on their own (Cohen, 2000). Because it is infeasible to evaluate all potential site locations by applying all potential operational criteria, site selection is usually limited to considering the most likely locations and applying the most relevant criteria while making sure that every viable option is considered (Ritter 1990). The recent development of massive electronic databases helps firms take on a much more comprehensive analysis and evaluation of more criteria and locations than in the past, although the process may remain incremental and limited in scope for some organizations (Blair and Premus 1987).

Site selection consists of several elimination rounds, where more detailed information and more criteria are considered. In the first step, the site selection team takes into account the overall corporate strategy and develops a list of criteria important to the success of the new facility, which are often divided into "must-have" and "would-like" criteria (Blair and Premus, 1987). The must-have criteria are elements the company cannot do without, instrumental to the firm's profitability or the successful achievement of objectives that motivated the move. The would-like lists are factors that are desirable but not crucial. Both categories are often described as negative attributes or things the firm wishes to avoid, such as an unfavorable climate, as eliminating locations because they lack crucial elements is much easier than trying to compare perceived advantages (Ritter, 1990). The next step involves gathering information about the potential locations and comparing them with the must-have and would-like list. Any location that does not meet the factors in the must-have list is eliminated; the remaining locations are then considered against the would-like criteria, with more and more locations eliminated and the list of criteria increased and viewed more stringently. Because every location has its unique set of qualities, both positive and negative, there is rarely one location that stands out above all others. At the same time that each site's potential is compared with the others, the importance of each would-like factor to the corporation's strategy and success is also evaluated.

When several locations are found to similarly possess important qualities, it is usually the seemingly insignificant factors that determine which location is ultimately chosen (Schmenner, 1982). When the finalists in a location search are similarly profitable in terms of traditional cost and market factors, Bartik (1991) found that differences in local incentives could make all the difference in which location is chosen. The regional and site-specific stages often have different location criteria to analyze (Blair and Premus, 1987); for example, an attractive location situated in an unattractive region may not be evaluated, with policies aiming to improve site-specific attributes being less effective in swaying corporate decision making if the larger region itself had fundamental defects in quality. Myers (1987) and Gottlieb (1994) suggested the use of a coordinated approach to improve the attractiveness of the entire region, as locations within a particular area are likely in competition with each other and any resources that are allocated to improving certain sites could be wasted.

2.3 Location Models

Since the early 1930's, as the process of site selection for modern retail sites increases in its complexity, academics and entrepreneurs have been creating and readjusting various models that help to better predict and measure the probability of success for particular sites. These range from the gravity model that Reilly suggested in 1929 to the location allocation and spatial interaction models of the present.

The concentration of economic activity from overlying trade areas was demonstrated by Losch (1967) to be the result of spatial coincidence in overlapping city trade functions. Losch believed that lattice point systems that comprised of various k values (which are, generally, spacing parameters) should be rotated to create as much overlap as possible, which thus gave rise to the famous city rich / city poor sector diagram (Losch, 1967). Each of the retail functions in Losch's model consisted of its own spatial frequency, and the alignment of the functions determined where two different lattices – centered on a common origin – might be aligned to create the maximum coinciding points. Arnoldo and Candea (1984) created a model that used the number, size and location of facilities within an organization as factors that would help achieve the minimum transportation, setup, and operation costs. In addition, it has been found that establishing a retail store or service facility in the best possible location is often a crucial factor in the facility's success (Achabal, et.al 1982, Ghosh and Craig 1986). Using a simulation study and empirical natural experiments, Rust and Naveen (1995) demonstrated that estimating geographically localized misspecification errors can reduce prediction errors when the predictor model is reasonably well specified. Jayaraman (1998) crafted a model where the interaction among facility location, inventory management, and transportation policies are created from site dependencies, utilizing mixed-integer programming methods to calculate the best network configuration in each case. The objective of the model consisted of achieving the most cost-effective distribution center locations in order to minimize transportation cost. O'Kelly and Murray (2004) studied location problems with a regularly spaced grid of new facilities and existing ones, by applying non-linear formulas and detailed solution approaches. Brubaker (2004) explored current site selection approaches and criteria utilized by community tenants, investigating whether the information can help developers improve retail site selection. General facility location problems were studied by Jia et.al. (2005) in order to create models that would address emergency situations, such as house fires and health care needs. Large-scale emergency characteristics were analyzed and a general facility location model suited for large-scale emergencies was proposed.

However, despite these tools and theories, developers "should not attempt to replace their instinctive reaction to a property with research. But they can no longer afford to depend solely upon that instinct. Effective site selection is neither a science not an art: It's a transcendental marriage of the factual parameters and intuitive passion that define the two disciplines" Hawkins and Foulger (2001).

2.3.1 Classification of Traditional Facility Location Models

The numerous facility location models can be classified according to constraints, objectives, solutions, or other attributes. Klose and Drexl (2004) proposed different classification systems for facility location models, with eight most common criteria used to classify traditional facility location models.

(1) Topological characteristics, where the topological characteristics of the facility and demand sites lead to different location models. These include the discrete network models (Daskin, 1995), the continuous location models (Plastria, 1987), and hub connection models (Campbell, 1994), where facilities can be placed only at locations that are allowed by the topological conditions.

(2) Objectives, where objectives are important in classifying the location models. The aim in these models is minimizing facility quantity while providing sufficient coverage to all demand nodes or maximizing the coverage in a facility where quantity has already been specified (Chung, 1986). P-center models aim to minimize maximum distance or travel time between demand nodes and facilities (Chen and Handler, 1993), and are often used to optimize locations of public sector facilities such as hospitals,

post offices and fire stations. P-median models aim to minimize the sum of distance or average distance between demand nodes and the nearest facilities (Rosing et al., 1979). Private sector companies tend to use P-median models to create facility distribution plans so as to improve their competitive edge. Readers interested in the numerous other applications and analyses involving P-center models may refer to Handle (1990), Brandeau et al. (1995), Daskin (2000), and Current et al. (1995).

(3) Solution methods, where different solutions result in different location models – such as optimization and descriptive models. Optimization models utilize mathematical methods, including linear and integer programming, to find alternate solutions that trade off important objectives against each other. Descriptive models use simulation or other methods to achieve enhanced location patterns repeatedly until the desired solution is reached. A combination of the descriptive models with optimization techniques has also been developed in order to tackle dynamic, interactive location problems (such as mobile servers) that preclude the use of traditional location models (Larson, 1974; Larson, 1975; Brandeau and Larson, 1986).

(4) Features of facilities, where the facility features divide location models into various types. Facilities restrictions can lead to models that do and do not contain service capacity (Pirkul and Schilling, 1991) while facility dependencies result in models that focus on facility cooperation or the lack thereof (Batta and Berman, 1989).

(5) Demand patterns can also be used to classify location models (Plastria, 1997). A model with elastic demand will have a varying degree of demand

in an area with each of the different facility location decisions (either increasing or decreasing the demand), while a model incorporating inelastic demand will find the demand does not change due to facility location decisions. Retail firm entries into an area are determined largely by local population (Shonkwiler and Harris, 1996).

(6) Supply chain type, or the single-stage model and multi-stage model, can be used to classify location models. Single-stage models are those that focus on distribution systems with just one stage, while multi-stage models look at the service flow through entire hierarchical levels (Gao and Robinson, 1994).

(7) Time horizon classifies location models into either static or dynamic. Static models aim to optimize system performance through considering all variable simultaneously, whereas dynamic models focus on data variation across different time periods and provide solutions for each period according to differences in the conditions (Erlenkotter, 1981).

(8) Input parameters are another way to categorize location models. Parameters are determined with specific values in deterministic models, resulting in simplified problems and quick, easy solutions (Marianov and ReVelle, 1992). It must be remembered, however, that for most real-world problems these parameters tend to be unknown and probabilistic in nature. Stochastic/probabilistic location models acknowledge the complexity in real-world problems through the probability distribution of random variables or by considering possible scenarios for the uncertain parameters (Owen and Daskin, 1998).

Other attributes can be used to categorize location models, such as single- vs. multi-product models or push vs. pull models. Readers interested in reading up on these classifications may do so through Hamacher and Nikel (1998) and Klose and Drexl (2004).

2.3.2 Location-Allocation Models

Deciding on a location has always been a critical decision; with the rapid growth and expansion of multi-facility retail networks, the decision has become much more complex and important. Organizing such networks is a difficult task, with traditional site selection approaches such as the Analog Model (Cohen and Applebaum, 1960) being unsuitable in such cases as they are limited to analyzing only single-store locations. The establishment of a network with two or more outlets necessitates a systematic evaluation of the impact that each store will have on the network, as well as consideration of "system-wide store-location interaction" (Achabal, et.al. (1982).

Weber in Friedrich (1929) made the earliest attempts to formulate location-allocation problems, where he tried to find the most efficient production point for an industrial plant with regards to its raw material sites and market location. By the early 1960s, researchers had come up with a mathematical solution to the Weber problem (Cooper, 1963), while Brandeau and Chiu (1989) utilized computer technology advances to apply these models to real-world planning problems. The allocation models for retail planning were grouped into five categories by Drezner (1995) as follows:

(1) P-median Models

Hakimi (1964) suggested finding the location for a given number (p) of facilities that minimized the average distance separate consumers had to travel from the nearest facility. The solution of the problem consisted of the p-weighted medians of the demand points, represented on a graph. The network version of the p-median problem mathematically defines w_i as the demand for retail goods in the i-th demand size, where I become the set of demand zones, J constitutes the set of feasible sites, and d_{ij} is the distance between i and feasible site j. The p-median problem can be written in the following equation form:

$$\text{Min} \sum_{i \in i} \sum_{j \in J} x_{ij} w_i d_{ij} \quad (1)$$

Subject to,

$$\sum_{j \in J} x_{jj} = p \qquad \forall i \in I \quad (2)$$

$$x_{ij} \leq x_{jj} \qquad \forall i \in I, \forall j \in J \quad (3)$$

$$\sum_{j \in J} x_{ij} \qquad \forall i \in I \quad (4)$$

where,

$x_{ij} = 1$ if $d_{ij} = \min\{d_{ik} | k \in J\}$;0 otherwise.

$x_{jj} = 1$, if and outlet is opened at j;0, otherwise.

The constraints used with this model ensure that there are only p facilities and that all consumers are allocated to a site that has at least one outlet. Models based on the p-median are helpful in determining which locations maximize the population's accessibility to retail services. A normative assumption for store-choice behavior (consumers visit the nearest outlet) is also utilized. This is most likely for such facilities as public facilities, fast food outlets, banks, health facilities, and post offices. The retail location models proposed by Goodchild (1984) and Hillsman (1984) are both based on the p-median problem.

(2) Covering Models

Covering models, originally developed for use in public sector location problems, is important in designing multi-unit networks for service-oriented retail firms where accessibility is a major criteria in patronage. Covering models are used to identify which locations provide potential users with the most access to service facilities in a certain distance or travel time. The Maximal Covering Location Problem (MCLP), proposed by Church and Revelle (1974), can be written mathematically as follows:

$$\text{Max} \sum_{i \in I} w_i y_i \quad (5)$$

subject to,

$$\sum_{j \in J} x_j = p \quad (6)$$

$$\sum_{j \in N_i} x_j \geq y_i \quad \forall i \in I \quad (7)$$

where,

y_i = 1 if demand point i is covered by an outlet (i.e., it has an outlet within a specific distance or time); 0 otherwise.

x_j = 1, if an outlet is opened at j; 0, otherwise

N_i, defined for each demand point, is the crucial operational variable in the model. The set designates the outlets considered accessible to the demand point i. Maximizing the demand covered is operationalized through Y_I, while constraint (7) limits the number of outlets to the specified number p. The MCLP has sprouted numerous interesting developments, including the Coherent Covering Location Problem (Serra, 1996) and the

Probabilistic Maximal Covering Location-Allocation models for Congested systems (Marianov and Serra, 1998). Mehrez and Stulman (1982) and Church (1984) tried to adapt the MCLP model to continuous space.

Toregas et al. (1971) first proposed the location set covering problem for locating emergency service facilities. Toregas and ReVelle (1972) stated that the objective of the set covering model was to find the minimum number of facilities, as well as the optimum locations of each, that were needed to serve consumers within a certain distance or travel time. For example, a manager may want to maximize potential consumers serviced by a fixed number of service centers. One of the applications of the Location Set Covering Problem (LSCP) is the warning siren study done by Current and O'Kelly (1992). The LSCP model formulation uses the following mathematical notations:

i = index of locations to be served;

j = index of potential facility sites;

d_{ij} = shortest distance between area i and potential site j;

S = effective coverage distance of a facility;

$N_i = \{j_j\ d_{ij} \leq S\}$;

X_j = 1 if potential facility site j is selected

0 otherwise.

It should be noted that the distance measure, dij, can be rectilinear, network, Euclidean (straight line), or any other metric/nonmetric based interpretation for the proximity between two places. Here, the Euclidean metric is used due to the nature of the service coverage being considered. LSCP equations follow:

Minimize

$$Z = \sum_j x_j \tag{8}$$

Subject to

$$\sum_{j \in N_i} x_j \geq 1 \quad \forall_i \tag{9}$$

$$x_j = \{0,1\} \quad \forall_j \tag{10}$$

The objective (8) is to minimize the number of facility sites needed to provide complete regional coverage. Constraint (9) specifies that each location must have at least one service facility, whereas constraint (10) imposes integer restrictions on the decision variables. When Murray and O'Kelly (2002) studied spatial representation in coverage-based location modeling, it was found that results were sensitive to how the spatial demand was represented in a digital environment.

(3) P-choice Models

The location-allocation models simulate consumers' shopping patterns. Based on spatial interaction models, Huff (1964) proposed probabilistic choice rules in order to introduce the revealed preference approach used in the "gravity" spatial choice models. The choice model can be written as follows:

$$p_{ij} = \frac{\dfrac{f(A_{ij})}{g(d_{ij})}}{\sum_{k \in K_i} \dfrac{f(A_{ij})}{g(d_{ij})}} \tag{11}$$

where A_{ij} is a measure of attraction of facility j to consumer i, d_{ij} is the distance or travel time separating consumer i and facility j and K_i is the sets of stores that are in consumer 's choice set. Two equation forms (8) commonly used in retail research include the Multiplication Competitive Interaction (MCI) model proposed by Nakanishi and Cooper (1974) and the Multinomial Logit (MNL) model (McFadden, 1974). Equation (11) has been used extensively to predict market shares of facilities in different locations, and the set of store attributes, A_{ij}, ought to include relevant characteristics from both store and location that are believed to influence consumer choice. Factors such as availability of credit card services, store size, number of checkout counters, location, and distance were used by Jain and Mahajan (1979) to explain the market share earned by individual outlets. Choice models have also been used to predict market shares of shopping centers (Weisbrod et.al., 1984) and hospitals (Lowe and Sen, 1996). The basic p-choice formulation states that:

$$\text{Max} \sum_{i \in I} \sum_{j \in J} w_i P_{ij} x_j \qquad (12)$$

$$\text{s.t.} \sum_{j \in J} P_{ij} = 1 \quad \forall i \in I \qquad (13)$$

where,

P_{ij} = The probability that consumers at i patronize facility at j.

w_i = The number of consumers at i.

x_j = is 1 if a store is located at j; 0, otherwise.

It can be seen from the formulation that the p-choice model is a generalized and unconstrained version of the p-median model, as the all-or-nothing consumer choice factor in the p-median problem is less stringent here and used as a probabilistic choice rule. The objective (12) of the p-choice model determines the set of facilities that would maximize the number of consumers served, the organization's expected market share, or the consumers' welfare capacity, depending on the model's nature. A p-choice model in discrete space was developed by Hodgson (1981), while Achabal et al. (1982) developed a p-choice model in a competitive discrete space and Drezner (1994) proposed another in a competitive continuous space.

(4) Consumer Preference Based Model

These are models that directly incorporate preference, where allocation rule is based on consumer evaluation of hypothetical choices rather than observed choices. One solution to the context dependency problem is the inclusion of locational structure measures in the choice function (Ghosh, 1984). Such measures are, however, difficult to implement without empirical research on the impact of locational structure on choice. Methods such as conjoint and information integration are used for this purpose, with conjoint analysis popularly used in marketing studies to measure the impact of brand and service statistics on consumer preferences (Witting and Cattin, 1989). In implementing the conjoint method, the first step is identifying store characteristics, which influence consumer preference as well as the levels that the attributes can potentially reach. The impact of various attributes on preference is evaluated through the use of calibration with linear-addition functions that relate outlet characteristics and utility. Parker and Srinivasan (1976) proposed one of the earliest consumer preference based location models, using conjoint analysis to determine how consumers evaluate different features of a primary care facility. Other conjoint method applications regarding retail include Louviere (1984), Ghosh and Craig (1986), and Munoz (1988).

(5) Franchise Models

These groups of models were developed for franchise-specific problems that occurred to franchise firms. Although franchise outlets operate in many similar ways to other retail stores, there are still a number of special issues that arise in regards to location decisions. Pirkul and Narashimhan (1987) and Ghosh and Craig (1991) developed the basic models, while Current and Sorbeck (1994) proposed a multi-objective model that helps select franchise locations and identifies the market areas for each individual one. Constraints used in the formulation ensure that franchise locations are assigned to a minimum market area that contains enough demand to ensure the economic survival of the franchise.

2.3.3 Competitive Facility Location Models

The location of warehouses, plants, and retail and industrial facilities, operating in a competitive environment, are dealt with within a subgroup of the location-allocation models. Competitive location models estimate market share captured by competing facilities in order to optimize location, and the best location for a new facility is the point at which the facility's market share is maximized. Hotelling's paper (1929) on duopoly in linear markets is agreed to be the first modern treatise on competitive facility location. In the paper, Hotelling studied the location of two competing facilities on a segment. The development of competitive location models that followed can be categorized in two groups based on spatial representation:

(1) Continuous competitive location models are those where the potential location of the facilities can be anywhere on the plane.

(2) Discrete competitive location models are those where facilities are allowed to be located at a certain finite set of possible locations on a network.

Many practical spatial planning problems were solved by Densham and Rushton (1991); the spatial decision support system (SDSS) was developed as a way to integrate data manipulation, the display capabilities of geographic information systems (GIS), and spatial analysis techniques and human problem-solving skills. The incorporation of spatial analysis has, however, proved difficult. In a microcomputer-based environment (Newton et al., 1988), spatial analysis techniques have yet to be implemented because applications tend to require large amounts of data storage and processing capabilities. The software developed by Schneider et al. (1976) and Lupien et al. (1987) only evaluates the consequences of location decisions chosen by other intuitive approaches.

Solving sizeable problems through the aggregation of data into smaller demand units results in serious problems with regards to errors in estimated values in objective functions and in identifying optimum locations (Goodchild, 1978; Casillas, 1987; Current and Schilling, 1990). Densham and Rushton (1991) proposed that to solve these problems without aggregating data required a new approach to system design. Ghosh and Craig (1991) studied the impact a new outlet created on form and brand demand as well as competition. A network optimization model was developed to evaluate potential locations with consideration toward system revenues and existing outlets. Eiselt et al. (1993) expanded the problem of locating three facilities in a tree and found that the equilibrium was dependent on weight distribution. In both models, organizations may choose locations on the edge of the network.

Miller (1996) described the facility location problem with regards to continuous or discrete space, while Dilworth (1996) identified three factors that would influence the establishment of a facility: market-related, cost, and intangible. The factors dictated whether a problem should be cast in continuous or discrete space. For example, a regional variability with respect to these factors may point to discrete space being more appropriate. Serray et al. (2002) proposed a decision model for companies entering spatial markets where several competitors are located, while Perales (2002) found that continuous competitive location models already include the revealed preference approach in the store choice models but that discrete competitive models only have it for profit maximization models. He realized that concentrated research for the incorporation of revealed preference approach in store choice models have not existed in the discrete competitive location models.

The model is represented by a discrete network in which consumers are located at specific points and potential locations for the service facilities are also pre-specified. The model is shown as follows:

$$\max Z = \sum_{i \in I} \sum_{j \in J} \alpha_{ij} x_{ij}$$

subject to:

$$\sum_{j \in J} x_{ij} = 1 \qquad i \in I \qquad (14)$$

$$x_{ij} \leq w_j \qquad i \in I,\ j \in J \qquad (15)$$

$$\sum_{i \in I} a_i x_{ij} \geq C w_j \qquad j \in J \qquad (16)$$

$$\sum_{j \in J} w_i = p \qquad (17)$$

$$x_{ij}, w_j \in \{0,1\} \qquad i \in I,\ j \in J$$

where:

i,I = index and set of demand areas

j,J = index and set of potential locations

b_i = Index of the closest existing outlet to node i

a_i = Demand at node i

d_{ij} = Distance between node i and node j

C = Minimum number of consumers required for an outlet to survive

p = number of facilities to locate

x_{ij} = 1, if node i is served by a facility at node j; 0, otherwise

w_j = 1, if an outlet is open at node j, 0 otherwise

$\alpha_{ij} = a_i$ if $d_{ij} \langle d_{ibi}$; 0, otherwise

2.3.4 Evolution of Models Used in Retail Site Selection

Reilly (1929) proposed one of the earliest formal methods for evaluating the potential attractiveness of retail locations. Based on the Newtonian law of gravity, his "Law of Retail Gravitation" predicted the retail areas of competing towns, cities, and shopping centers by the use of population and distance data. It was assumed that the amount of retail activity and shop space was directly proportional to the city or town's population, as almost all retail activity in the 1920s and 1930s was located in the city or town center. The existing retail space was related to the municipality size.

Reilly (1929) defined his model as follows: in normal conditions, two cities draw retail trade from the smaller city or town in direct proportion to some power of the population of the two larger cities and in an inverse proportion to some power of the distance of the cities from the smaller one. The exponents connected with population or distance depends on a combination of retail circumstances in the particular case. In mathematical form, Reilly's law can be states as follows:

$$\frac{B_a}{B_b} = \left[\frac{P_a}{P_b}\right]^N \left[\frac{D_a}{D_b}\right]^n$$

Where:

B_a = The percentage of the area's consumers who will travel to city a

B_b = The percentage of the area's consumers who will travel to city b

P_a = The population of city a

P_b = The population of city b

D_a = The distance in miles form the area to city a

D_b = The distance in miles from the area to city b

N = exponent showing relative attractiveness of a larger population size (N=1 used by Reilly)

n = exponent showing relative attractiveness of shorter distance (n=2used by Reilly)

Further development in the gravity or spatial interaction model in the late 1960s gave way to David Huff's calculation of probability, which considered the probability of whether a consumer who lived at a particular location would shop at a certain retail center. When consumers make shopping choices, Huff argued, they considered various shopping options and would visit several different stores at different times rather than just one retail center, as stated by previous models. The assumption in his model was that the utility of the retail outlet was a function of the outlet's size and the travel time from the consumer's residence. The retail center was based on the utility ratio of one store to the sum of the utilities of all centers the consumer had considered to go for shopping.

Carlton (1983) created a model for the location of new branch plants across standard metropolitan statistical areas (SMSAs) in the United States; Carn et al. (1988) redefined the model Reilly used by replacing his variables with the retail district size and drive times, in order to determine the utility perceived by consumers in the given area; while Ellwood was the first to create a model that allowed trade areas to be defined within (instead of between) metropolitan areas. Also, heuristic approaches for specific capacitated location problems were studied by Pirkul and Schilling (1991), Current and Storbeck (1988) (capacitated covering models) and by Cornuejols et al. (1991) (capacitated plant location problems) among others. A multi-criteria, multi-period model that helped determine the optimal relocation site as well as the phase-out schedule of a combination manufacturing-and-warehouse facility was proposed by Melachrinoudis et al. (2000), with the multi-objective, dynamic two-echelon model was presented through the use of Linear Physical Programming (LPP). Figueiredo et al. (2002) demonstrated that when one took advantage of the relations between the conditional logit model (CLM) and the Poisson regression likelihood functions, one could more effectively control the potential. In addition, recent empirical research resulted in a model for the firm location decision problem through utilizing Poisson (count) models and spatial data sets at the micro level (Papke (1991), Wu (1999), Coughlin and Eran (2000) and List (2001)).

2.3.5 Consumer Choice Models

Consumer choice models applied to retail attraction have been in use for years (Huff 1964; Fotheringham 1980; Louviere 1984), where these models predict store choice based on numerous variables. It is, however, impossible to include all variables that affect choice, because some variables may be difficult to measure and thus are not practical to include whereas others have not been identified or conceptualized by the researcher (Inagaki 1977; Rust and Schmittlein 1985). This has stimulated researchers to propose more complicated models (Fotheringham 1980; Currim 1982; Kamakura and Srivastava 1984; Batsell and Polking 1982); however, the simple model is sufficient in demonstrating the concept of geographically localized misspecification errors.

It is assumed that the utility Uij of chain j to individual i is

$$\text{Uij} = \exp\lfloor \alpha d_{ij} + Y_{ij}\beta + \delta_{ij} \rfloor \qquad (18)$$

where

dij = Distance from individual i to the nearest store in chain j

α = A coefficient on distance, assumed to be homogeneous across individuals

Yij = A vector of predictor variables other than distance

β = A vector of coefficients, assumed to be homogeneous across individuals

δ_{ij} = A random error term, assumed to be distributed extreme value and that the probability of individual i choosing chain j is

$$\text{Pij} = \text{Uij} / \sum_k U_{jk} \qquad (19)$$

Subsequently, the parameters of this model will be estimated using logit regression.

The error term, δ_{ij}, can be broken down into two components: deviation based on the impact of the omitted predictor variables, and deviation due to random sampling error. The impact of omitted predictors is what is called misspecification error. In other words,

$$\delta_{ij} = \text{MEj(Xi)} + \epsilon\text{ij} \qquad (20)$$

with

MEj(Xi) = model misspecification error at point Xi

ϵij = random sampling error, assumed to have mean 0 but with no specific distribution assumed.

It is assumed that the combined distribution of model misspecification error (residuals of the unobserved variables) observed across data points plus sampling error is an extreme value, which is not the same as assuming ϵij is a distributed extreme value at any data point. In fact, no strong distributional assumption is required on ϵij.

Guimares, et al. (2000) relied on narrowly defined spatial choice sets, and their subsequent research has created models for location choices among highly aggregated regions, such as the U.S. states (Bartik (1985), Coughlin, et al. (1991), Friedman, et al. (1992), Friedman, et al. (1996), Head, et al. (1995), Levinson (1996), Head, et al. (1999)).

2.4 Definitional Parameters

2.4.1 Land

Land is the area or space that includes both solid mass such as mountains and non-solid mass such as water sources (Act 2545-2548).

2.4.2 Title deed

A title deed is a piece of paper that shows rightful ownership of property, which may include a map. In relation to this, trading land means purchasing, receiving, selling, or giving land for profit by way of sale, exchange, or hire purchase.

2.4.3 Property

Property is the exclusive right to control an economic good, either private or public. Private property is exclusive right of a private person to control an economic good, and public property is the exclusive right of a political unit (city, state, nation, etc.) to control an economic good. In the most basic level, urban economic activities generate a need for land and property that may be met with the existing buildings and property or through new development. These needs are usually mediated through a market process that determines property value, allocates building space among competing uses, and stimulates development and redevelopment of new space, among other things.

2.4.4 The property market

A market is a place where parties trade interest in goods and services. The market is an institutional construct that reflects social patterns of power and influence, providing context for the activities of those who participate in market activities in order to develop, use or invest in property (Keogh and D'Arcy, 1994). The market is non-static and functioning within a framework of legal and policy constraints, with market behavior inevitably adapting to pressures for urban change.

2.4.5 Property rights

These are institutional interests with characteristics of exclusivity, inheritability, and transferability, backed by enforcement means (Alchian and Demsetz, 1973).

2.4.6 Tenure security

Uncertainty over titles has inhibited the efforts of the poor, who value ownership and may also require it for credit eligibility (Rodwin and Sanyal, 1987). Resulting are constrained property transactions, depressed incentives for construction and upgrading, unwillingness on the part of lenders to extend credit to property holders for property investment, and limited property tax. Very often, the infrastructure is compromised because costs are unrecoverable. Tenure security is support through clear registration protocols that are vital to establishing functional property markets.

2.4.7 Property development

Property development is the process by which buildings are constructed for use, occupation, sale, or investment. It is a key part of urban capacity and quality, with growth and sustainability facilitated by the development, construction, and refurbishment of sites and buildings against the dynamic, unpredictable demand for locations and buildings.

In developed countries, property development is supported by a functioning property market, which is facilitated by appropriate legislation and institutes. For successful property development, legal, professional, and financial institutions must be in place. The situation is different in most developing countries that are in the midst of significant economic and structural adjustment. Each country's changes and extent of economic realignment varies, as well as institutional reforms regarding foreign investment laws and incentives, banking procedures, financial regulation, adoption of property rights, and the like (Goldsbrough et al., 1996).

2.4.8 Macroeconomic context

Property development is a means to revitalize an economy through encouraging investment and as a means of facilitation the production process to gain better economic growth and added value from a macroeconomic view (Isaac, 1996). Property development accounts for 50-60 percent of gross fixed capital in many developing countries, while housing and other sectors such as construction contribute to more than 18 percent of the GNP in developed countries.

2.4.9 Right property

Right property accompanies the title deed – the title deed itself is the paper that shows the right property and may include a map and a document of land ownership. In relation to this, trading land means purchasing, receiving, selling, or giving land for profit by way of sale, exchange, or hire purchase.

2.5 Land Reforms

Administration reforms occurred during the Ayudhaya period, from B.E.1350-1767. One of the reforms was an arranged government service system in the reign of King Boromatrailokanart in B.E. 1448-1488, with four ministries to govern: Weng, Wang, Krang, Na (Jatusadom). Levels of honor were also developed.

The administration revolution occurred in the Rattanakosin era, with twelve ministries existing on April 1, 2435. Up to now the present time, the government has changed systems to accommodate many objectives, such as:

(1) Reducing ambiguity of duties

(2) Reducing people in system

(3) Increasing work productivity

(4) Rearranging budget

(5) Canceling or correcting out-of-date laws and regulations

(6) Decentralizing

(7) Applying more technology to become an e-government

(8) Creating good governance in administration

Act (no.5) 2545 listed twenty ministries. Some ministries changed their mission and name, while others have created new missions. There is a Ministry of Defense, Ministry of Foreign Affairs, Ministry of Finance, Ministry of Industry, and so on. All ministries have numerous departments within their authority, help reach their objectives.

Urbanization causes changes in land use and at the same time brings about increasing environmental loads due to the increasing use of energy and resources, which also creates negative impacts on human health and the ecosystems. Japan experienced rapid urbanization and industrialization in its economic growth period in the 1950s and 1960s. Industrialized areas were created on land reclaimed from the sea, and a large number of workers and their families flocked to these industrial cities, attracted by the lure of work. It did not take long for a series of environmental problems to develop as a result of the industrial expansion. The demand for food, water, and energy from cities has affected the entire world, with pollution affecting locations both near and far. The changes in land use is also a result of urbanization as well as a cause of a number of environmental problems, all of which display the direct and indirect consequences of human activities on the natural environment (Chen, IMURA, Matsumoto).

2.6 Factors Relevant to Location Decisions

Location databases have been built by both the public and private sectors for their specific needs. These scattered databases are difficult to integrate, and the accuracy and consistency of the data contained within the numerous databases cannot be verified. Much effort has been spent toward the development of location databases by location researchers and planners for different purposes, as follows:

Hoffman and Schniederjans (1994) proposed a two-stage model that merged the concepts of strategic management and microcomputer technology, to provide a more efficient and effective method for managers to evaluate facility sites before making their decisions. This global facility site selection model considers the variables that fall in the scope of environmental factors, which have been identified in previous international business models. The external variables included in the model are as follows:

(1) Economic factors, which include variables such as currency transfers, currency parity, wage level, tax rates, interest rates, construction costs, price controls, business cycles, inflation and overall economic condition.

(2) Social factors, which include demographics, crime rate, language, roles of women and minorities, career expectations, work ethics, average education of the potential workforce, and overall community atmosphere.

(3) Political factors, which include the probability of tax relief on the importation of construction materials and machinery, relationships preventing the firm's entry into a foreign location or relationships preventing the continuation of the foreign operations, probability of an income tax holiday, protection laws, tax relief on the purchase of local construction material, and any other government regulations or restrictions that could affect operations.

(4) Technical factors, which include product and service quality, related cost factors, raw materials, the general rate of technological change, and innovation.

(5) Physical factors, which include climate, seasonality, the probability of natural disaster, availability of existing facilities and equipment, access or proximity to highways and airports, and proximity to shopping, restaurants, night-life, cultural activities, sports activities, spectator sports and other outside attractions.

(6) Task environment factors, which include untapped demand, projected consumer base, the prices that existing facilities in the subject locale command, market growth, number and strength of competitors, and accessibility to supply sources.

The critical factors were identified and defined by different authors before being organized and integrated (Badri, 1995). Measures of organizational quality management were proposed for both manufacturing and service firms, with quality literature put out that identified eight critical areas of quality management with regards to a sole business unit. These include such things as the role of divisional top management and quality policy, the role of quality department, training, product/service design, supplier quality management, process management/operation procedures, quality data and reporting, and employee relations. This list of factors is shown in Table C.1.

Kwak (2002) identified the factors that caused international development projects, completed or in-progress, to be challenged. The factors were then categorized into ten major issues based on their nature: political, legal, cultural, technical, managerial, economical, environmental, social, corruption, and physical. This is shown in Table C.2.

A chronological summary of research on general industrial location was studied by Jungthirapanich and Benjamin (1995). An extensive literature review was done on documents related to locating a manufacturing facility within the United States. The study found a hierarchy of eight location factors that influenced the decision, ranked from most important to least important with "market" being most important and "community development" being least important. These factors are summarized in Table C.3.

Scherrer (2002) proposed a framework for categorizing the factors that determine location quality, which was put into five groups of hard location factors and four groups of soft location factors. Service providers and manufacturing firms placed different weights to the items in a specified set of factors, as some factors that were relevant for service providers may not be relevant to manufacturing firms at all. Each of these factors can basically be sub-categorized into various categories as shown in Table C.4, C.5.

Prieler et al., (1998) analyzed the factors shown in Table C.6 and provided the information necessary to develop useful scenarios for future land use in a particular region. The importance of each factor varies, depending on the region studied. In Europe, for example, factors that are especially important include agriculture, forestry, environmental conditions, market development, policies related to land-use planning, and social context (including the region's history).

Yomralioglu and Parker (1993) explained the land readjustment process, where land valuation factors affect a land's parcel value. Land readjustment (LR) can be defined as a land management tool that assists urban development, with the objective being the conversion of irregularly developed land parcels into suitable land. It is a technique to manage the development of urban-fringe lands where separate land parcels are unified in a single estate, with redistribution of the new building back to the original landowners. The value used is a numerical parameter instead of the real market value, and the numerical parameters are derived from a combination of selected land valuation factors shown in Table C.7. Despite the fact that LR is a great tool in finding solutions to land-use problems in urban areas, limitations plague present implementation. These include economical limitations in compensation for acquiring land, technical limitations in handling the wealth of data, and social limitations in minimizing inconvenience and conceived injustices.

Wu et al. (2004) proposed a way to develop standard criteria consumers use to select mobile shopping sites, providing support for the three factors that measure consumer evaluation such as merchandise, assurance, and enabling functions.

Bhutta (2004) examined the existing literature regarding factors involved in global trade and the taxonomy of existing analytical models. Feasibility studies must be conducted for issues such as global distribution, product marketing, and use of logistics companies in transporting goods to global markets. Bhutta (2004) also stated that companies in the various stages of globalization need to incorporate many factors in their operational decision-making in their overseas facilities. Multinational corporations (MNCs) need to consider these factors simultaneously in order to make optimal decisions, as the factors are interrelated and can directly impact the firm's profitability in Table C.8.

Stewart and Morris (2002) surveyed eleven factors that were found to be significant obstacles to entry into underserved markets. These factors, in descending order of importance, are:

(1) Crime/perceived crime

(2) Insufficient concentration of the retailer's target consumer

(3) Lack of consumer purchasing power for the retailer's product

(4) Potential shrinkage

(5) Rent

(6) Build out/rehabilitation costs

(7) Site identification

(8) Inadequate parking

(9) Higher operating costs

(10) Construction and development costs

(11) Lack of amenities to attract out-of-neighborhood employees

Yang (2004) identified and tested the importance of location factors in location decision making for different industry sectors. The influential factors were identified, as shown in Table C.9. The research was done to examine the interrelationships between the decision making process (which consisted of regional and specific location factors, information processes, key decision-makers and their influence) and the organizational structure of firms.

Sergot (2003) assessed the importance of spatial momentum and the imitation and use of managers' social ties in location choices. Three types of location behaviors were stronger in SMEs compared to large firms. The result of the Principal Component Analysis performed on location factors thus led to the identification of three aggregate dimensions that corresponded with the way decision makers gain knowledge on a geographical place before locating an establishment Table C.10.

Whitelock and Jobber (2004) studied key decision makers in a sample of large international companies exploring international market entry decisions. Statements were factor-analyzed, revealing ten specific variables that were further analyzed to see which discriminated between the decision to enter and not enter a new international market. It was found that geocultural/political similarity, the level of development in the economy, the attractiveness of the market, available market information, and governmental attitude significantly affected the decision. These findings supported a marketing-strategy based theory of market entry.

Saraph et al (1989) organized and synthesized various sets of critical factors, proposing the measurement of overall organizational quality management for both service and manufacturing firms. Measures of organizational quality management were proposed for both manufacturing and service firms, with quality literature put out that identified eight critical areas of quality management with regards to a sole business unit. These include such things as the role of divisional top management and quality policy, the role of quality department, training, product/service design, supplier quality management, process management/operation procedures, quality data and reporting, and employee relations.

Mazzarol and Choo (2003) focused their research on providing further insight into the decision-making process of small and medium firms with regards to their selection of industrial land.

Foster (2002) studied distribution center site selection to support demand and distribution pattern changes. Each site and facility had its own combination of factors, some of which focused on geography, land and building costs, taxes and incentives, labor needs and the nature of the activity to be performed in the distribution center.

Despite various complexities, DC site location process almost always follows a predictable path that is governed by a few important factors, two of which are key decision drivers that guide all other DC site location considerations:

(1) Alignment with the company's strategic plan.

(2) Requirements of the targeted consumer base.

The seven tactical considerations allowing a company to reach its final DC site location decision include the following:

(1) Minimization of freight costs;

(2) Availability of sites at advantageous costs;

(3) Access to major arteries/shipping nodes;

(4) Minimization of facility and operating costs;

(5) Availability of workforce at advantageous pay rates and attractiveness;

(6) Availability of government assistance in the form of tax abatement, low-cost financing, training credits, and other incentives; and

(7) Impact upon the local community and the environment.

Research on the purchase decision associated with industrial land usually focused on the factors influencing location election (Haigh, 1990; Decker and Crompton, 1993; Hughes, 1994; Brush et al., 1999). Although most of the research focused on the decision-making processes of large firms, some attention had been given on how SMEs make such decisions. For example, a study of 87 Australian SMEs undertaken by Kupke and Pearce (1998) found that two of the most important industrial location factors for owner-managers included being close to the central business district (CBD) and having direct access to main roads, which was consistent to the findings of large firms.

Another study (SHP, 1999) of medium to large firms identified six factors that influenced location selection. These, in order of importance, were:

(1) Accessibility to the CBD;

(2) Cost of land;

(3) Freeway access;

(4) Proximity to consumers;

(5) Attractiveness of area; and

(6) Nearness to suppliers.

Tong (1979) took a survey of 242 foreign-owned manufacturing firms and found that the most important factors affecting their location decisions were nearness to markets; transportation services; space for expansion; labor attitudes; and availability of a site. The least important considerations were nearness to home country; cost and availability of capital; proximity to export markets; and nearness to operations in third countries. In a survey of 21 West German and Japanese firms located in the Charlotte-Mecklenburg, North Carolina area found that the most important factors included the availability of desirable sites, attractiveness to incoming personnel, and market access, whereas less emphasis was placed on financial incentives, labor, and access to raw materials and semi-finished goods.

Haigh (1990) studied 20 foreign companies (mainly Japanese, German and Swiss) in the USA, which highlighted the important role played by state and local economic development agencies in influencing the decisions in the site selection process. This typically involved three fairly distinct stages:

(1) The selection of a specific geographic region in the USA;

(2) The selection of two or three states within that region; and

(3) The final decision on a specific site in a particular community, usually a choice among four or more locations in any given state.

Willoughby (2000) surveyed meso-organizational literature from fields such as geography, urban studies and regional planning. Felsenstein and Shachar (1988) demonstrated that metropolitan location is important for high technology firms both large and small in Israel, but with different reasons in each case. Davelaar and Nijkamp (1989) found that spatial factors were associated with the performance of high technology firms in the Netherlands. Depending on whether the firm's focus was on process or product innovations, there were distinctions in regards to the importance of highly urbanized locations.

Five factors that were identified as strongly influencing international location decisions included costs, labor characteristics, infrastructure, government, and political and economic factors, with sub-factors identified as existence of modes of transportation, quality and reliability of modes of transportation, quality of labor force, availability of labor force, motivation of workers, quality and reliability of utilities, wage rates, telecommunication systems, record of government stability, and industrial relations laws. These factors are summarized in Table C.11. Both quantitative and qualitative aspects covered by the factors and sub-factors and are relevant to location decisions include the strategic, economic, operational, political, social and cultural dimensions (MacCarthy and Atthirawong, 2003).

2.7 Locational Decision-making in Retailing

The development of database and geographic information systems (GIS) to aid strategic retail decision-making was studied by Malley, et al. (1997). Retail decision-making involves a degree of risk, where store location is the most critical decision that a retailer can make (Clarkeson et al., 1996). As a result, a premium is placed on access to timely, accurate, and relevant information.

GIS is a powerful technological tool with regards to data storage, analysis, and visualization, combining both information and mapping systems to use as analytical and modeling tools (Goodchild, 1991); its power lies in the fact that it can manage numerous data sources once a link between the data and a geographic element such as a postal code have been identified. Tabular data from a retailer would likely include information from diverse sources, including consumer transactions, merchandising, and surveys. Retailers may wish to study the purchasing behavior of populations, monitor competitive impact, and/or set targets based on individual stores' physical, marketing and area attributes (Beaumont, 1991; Moore and Attewell, 1991; Robins, 1993), and at the same time make use of external data sources such as lifestyle databases, TGI, and depending on area, a National Shoppers Survey (Squires, 1995). These have advantages over geodemographic data because they are updated more frequently and include purchasing and lifestyle data. Moore and Attewell (1991) described a system developed by Tesco's site location unit in detail and verified that retailers combine several sources of data within their internal systems (Sleight, 1993). The use of loyalty schemes had not existed among the retail categories surveyed at the time, although it is clear now that loyalty schemes have escalated in importance. Some retailers even suggest that it is a significant and potentially powerful source of data (Evans et al., 1997). Data stored within an organization could be one of the most important and underutilized resources in effective corporate decision making (Hopwood, 1989). Although there are now numerous information sources and retailers have become rich in data, it seems that they collect more and more data and yet rarely use that data in productive or creative ways (Foust and Botts, 1992). Hernández et al. (1995) indicated that corporate data management is important for successful data collection and usage.

The importance of location has been long applied in the field of retailing (Brown, 1992), but has yet to be extended into the analysis of small independent companies. Large multinationals with locational strategies and decision-making characteristics have been the ones to utilize it (Bennison et al., 1995; Clarke, 1998; Clarke et al., 1994). Decisions were often made on a subjective or intuitive basis; Guy (1980) indicated that the constraints on a shopkeeper's choice of location included cost and familiarity with the area. Small retailers also have a degree of geographical inflexibility, as the owners often locate new facilities near their existing ones, whether or not it was the optimal location. Hernández et al. (1995) audited the sources of data available to retail decision-makers, while at a micro scale, the impact and role of location within relatively small locales such as town and city centers have also been considered (Brown, 1987; 1992).

More scientific methods regarding location planning are now in place (Hernández and Bennison, 2000), with sophisticated techniques such as neural networks and the GIS used to aid locational decision-making. The GIS, being computer-based, allows presentation and visualization of geographic data. The role and potential of GIS as a decision support tool has been evaluated by some researchers (Nasirin and Birks, 2003), especially in locational planning and decision-making (Clarke and Rowley, 1995). Byrom (2000) concurred the current role and use of geographical information in locational decision-making through an assessment of decision-makers' use and awareness, locational decisions, and purpose. GI-related research in retailing and services has been in the form of geodemographics, which are 'the analysis of social and economic data in a geographical context for commercial purposes related to marketing, site selection, advertising, and sales forecasting (Goodchild, 2000).

Locational planning frameworks that were developed and applied to multiple retailers may be relevant to small independent retailers as well, with the importance of organizational context recognized in Hernández et al.'s (1998) model of "Retail locational planning and decision making," shown in Figure 2.3. The model illustrates the various interactions that impact location decision-making. Therefore, at the strategic, tactical and monadic levels in the decision-making hierarchy, the external environment where the firm operates and its internal characteristics affect location, including location mix and administration of a property portfolio.

Hernández et al. (1998) suggested that retail locational planning and decision-making were closely related to "the structural and cultural characteristics of companies," with the retail locational planning model utilized as a template for the analysis structure of the case study. It was demonstrated that macro-, meso-, and micro-environmental influences influenced company objectives with regard to locational decision-making from strategic to tactical levels. The '6 Rs of the location mix' that illustrate this are shown in Table 2.1.

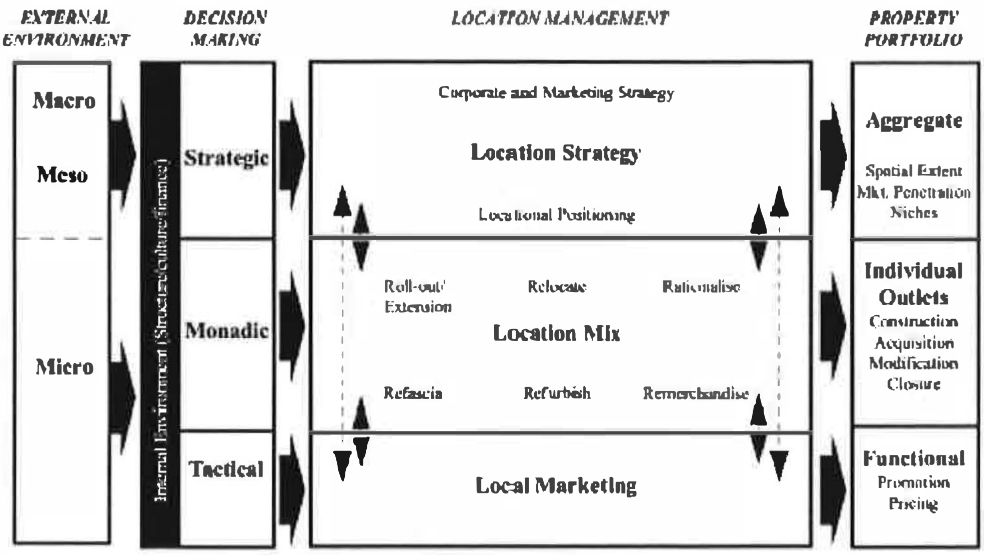

Figure 2.1. Retail Locational Planning and Decision-making.

Table 2.1. The 6 Rs of the Location Mix (Hernández et al., 1998).

Type of Decision	Description
Roll-out	Increasing floor space in existing store or opening a new store
Relocation	Moving to a new site due to close proximity of two stores, or availability of a new retail pitch
Rationalization	Closure of individual stores, or selling of divisions
Refascia	Altering image of outlets by changing their name/appearance
Refurbishment	Updating fittings
Remerchandising	Altering product range of a retail location, tailoring offer to the local consumer

A criticism of the valuation method is the extent that it considers the impact of locational, physical and lease-term characteristics on location selection decisions of retailers in the open market (Adair et al., 1996). Retail analysts must therefore use their judgment when applying theories or extrapolated figures from one situation or store to evaluate another (McGoldrick, 1990). The more data accumulated together with the number of influential factors, the more complex and difficult the causal relationship becomes to project. In addition, there is also the consideration that hedonic consumption, multi-sensory and emotional factors of retailing, may influence shopping behavior inside a store (Mason and Mayer, 1990).

III. RESEARCH METHODOLOGY

This chapter presents the research methodology that was used by this research study. These methods included the concept of structure model, sources of data, research instrument, sample size, data reduction technique, Principal Component Analysis (PCA), and the confirmatory factor analysis (CFA) in the structural equation modeling (SEM) process.

3.1 Research Framework

Retail location factors were analyzed through a systematic construction model, as shown in Figure 3.1.

From a comprehensive list of retail location factors that were collected from primary and secondary data, the research study focused on certain confirmed ones for the results, which were used to develop and construct the model of retail location factors.

Figure 3.2 is a data management diagram for facility location, in the form of a decision tree. The diagram was generated from the bottom-up and top-down approaches and based on a decision tree in order to analyze facility location data. An exhaustive list of location factors from a data search from all available sources in private, government, and non-government organizations in Thailand is located at level 0, totaling 228 location factors. Whether the data was primary or secondary is distinguished in the model, with the left being secondary data and the right being primary and interpreted between available and unavailable data support.

Level 1 is a factor group node within which statistical methods were applied to test the validity of the factors, through the use of factor analysis. Many factors were grouped by the principle component analysis (PCA) in SPSS 12.0 in order to reduce the number of variables, and AMOS 5.0 was used to confirm the factors' correlations.

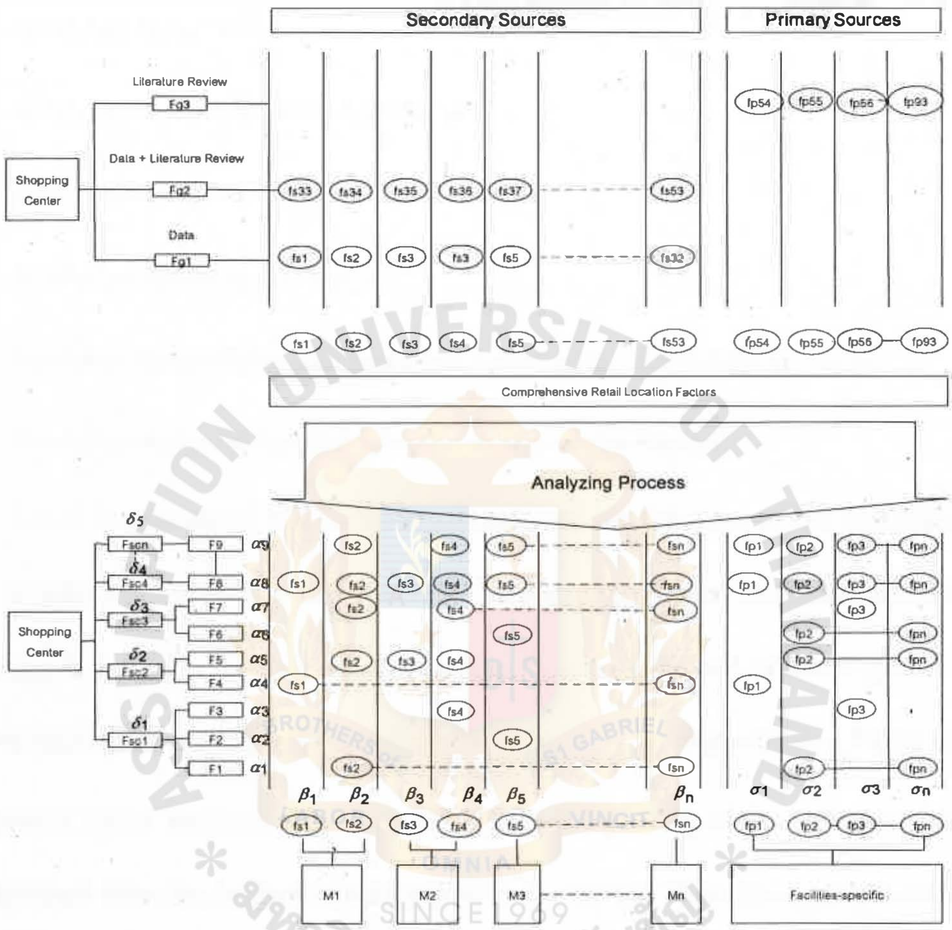

Figure 3.1. Structural of Retail Location Factors (Somprakij and Jungthirapanich 2005).

On the secondary side, $\beta_1, \beta_2, \ldots \beta_n$ stand for the coefficient factors with which the factor groups are composed, contributing the main key factor in the state. On the primary side, the available data from the numerous ministries are sorted in factor groups. The factor group node function can be written in terms of their variables in the shopping center area, as shown in equations (1) to (9) below:

$$F_1=\beta_2 F_{s2}+\beta_{sn} F_{sn}+\sigma_2 F_{p2}+\sigma_n F_{pn} \tag{1}$$

$$F_2=\beta_5 F_5 \tag{2}$$

$$F_3=\beta_4 F_{s4}+\sigma_3 F_{p3} \tag{3}$$

$$F_4=\beta_1 F_{s1}+\beta_n F_{sn}+\sigma_1 F_{p1} \tag{4}$$

$$F_5=\beta_2 F_{s2}+\beta_3 F_{s3}+\beta_4 F_{s4}+\sigma_2 F_{p2}+\sigma_n F_{pn} \tag{5}$$

$$F_6=\beta_5 F_{s5}+\sigma_2 F_{p2}+\sigma_n F_{pn} \tag{6}$$

$$F_7=\beta_2 F_{s2}+\beta_4 F_{s4}+\beta_n F_{sn}+\sigma_3 F_{p3} \tag{7}$$

$$F_8=\beta_1 F_{s1}+\beta_2 F_{s2}+\beta_3 F_{s3}+\beta_4 F_{s4}+\beta_5 F_{s5}+\beta_n F_{sn}+\sigma_1 F_{p1}+\sigma_2 F_{p2}+\sigma_3 F_{p3}+\sigma_n F_{pn} \tag{8}$$

$$F_9=\beta_2 F_{s2}+\beta_4 F_{s4}+\beta_5 F_{s5}+\beta_n F_{sn}+\sigma_1 F_{p1}+\sigma_2 F_{p2}+\sigma_3 F_{p3}+\sigma_n F_{pn} \tag{9}$$

Level 2 consists of the location alternatives. In the case of the shopping center, F_{sc} was used to express the function that the shopping center has many locations (e.g., F_{sc1}, F_{sc2}, F_{sc3}, F_{sc4},.......F_{scn}). As an example, F_{sc1} is composed of factor group 1, 2, and 3, with each node having individual coefficients $\alpha_1, \alpha_2, \alpha_3$ respectively. Alpha shows the component factor analysis value accounting for the percent of the variance. Each alpha is dispensed from the highest contribution to the lowest; therefore, prioritized data will be used within the time constraints. As a result, many shopping centers generated up to level 3. The parameters derived from Figure 3.2 can be expressed with the location alternatives function equations, as can be seen through (10) to (14) below:

$$F_{sc1}=\alpha_1 F_1+\alpha_2 F_2+\alpha_3 F_3 \tag{10}$$

$$F_{sc2}=\alpha_4 F_4+\alpha_5 F_5 \tag{11}$$

$$F_{sc3}=\alpha_6 F_6+\alpha_7 F_7 \tag{12}$$

$$F_{sc4}=\alpha_8 F_8 \tag{13}$$

$$F_{scn}=\alpha_9 F_{scn} \tag{14}$$

When location alternatives have been integrated into the type of facility, level 3 occurs. The author ferrets out the relationship among the facility types – for example, a shopping center type could have a relation with each component, becoming a function of shopping center place 1, and the function of shopping center place 2, 3, 4, and n respectively. The delta was used to represent the coefficient of each location, and the location alternatives function can be written as per equation (15) below:

$$F_{sc} = \delta_1 F_{sc1} + \delta_2 F_{sc2} + \delta_3 F_{sc3} + \delta_4 F_{sc4} + \delta_5 F_{scn} \qquad (15)$$

The multiple regression method was utilized to generate the coefficient values in each component in the equation, in order to obtain the formula. Special note taken on the box sum of the shopping centers used for counting the factor quantity in the function, as well as the main factors in each facility type.

Called the community level, level 4 is the integration of many facility types. In the diagram, community 1 was composed of a shopping center, hospital, police station, and various other places, with $\lambda_1, \lambda_2, \lambda_3, \lambda_n$ representing their coefficients respectively. They can then be merged into the community function (16) below:

$$F_{community1} = \lambda_1 F_{sc} + \lambda_2 F_h + \lambda_3 F_{ps} + \lambda_n F_{op} \qquad (16)$$

Level 5 compiles many communities into a main function of facility location, also known as the city level. The city plan should be managed systematically in terms of the criteria for facility location management. The city level functions are a combination of many related communities with $\rho_1, \rho_2, \rho_3, \rho_4, \rho_n$ representing their coefficient value, which can be written in terms of equation (17) below:

$$F_{city} = \rho_1 F_{community1} + \rho_2 F_{community2} + \rho_3 F_{community3} + \rho_4 F_{community4} + \rho_n F_{communityn} \qquad (17)$$

Each facility type's box sum shows up with the frequency of factors and comprises an indicator of facilities type in level 3. It is an advantage for researchers to know which factors are more important and higher in quantity or frequency when considering a long list of such factors. The frequencies in each facility can be added together to become the sum of that particular community level. The model that is used in this research focuses up to the community level. Its sum is processed through setting collection priorities and assigning them to the relevant ministries. On the primary side, the lacking factors are further collected in order to have a complete data set with regards to facility locations.

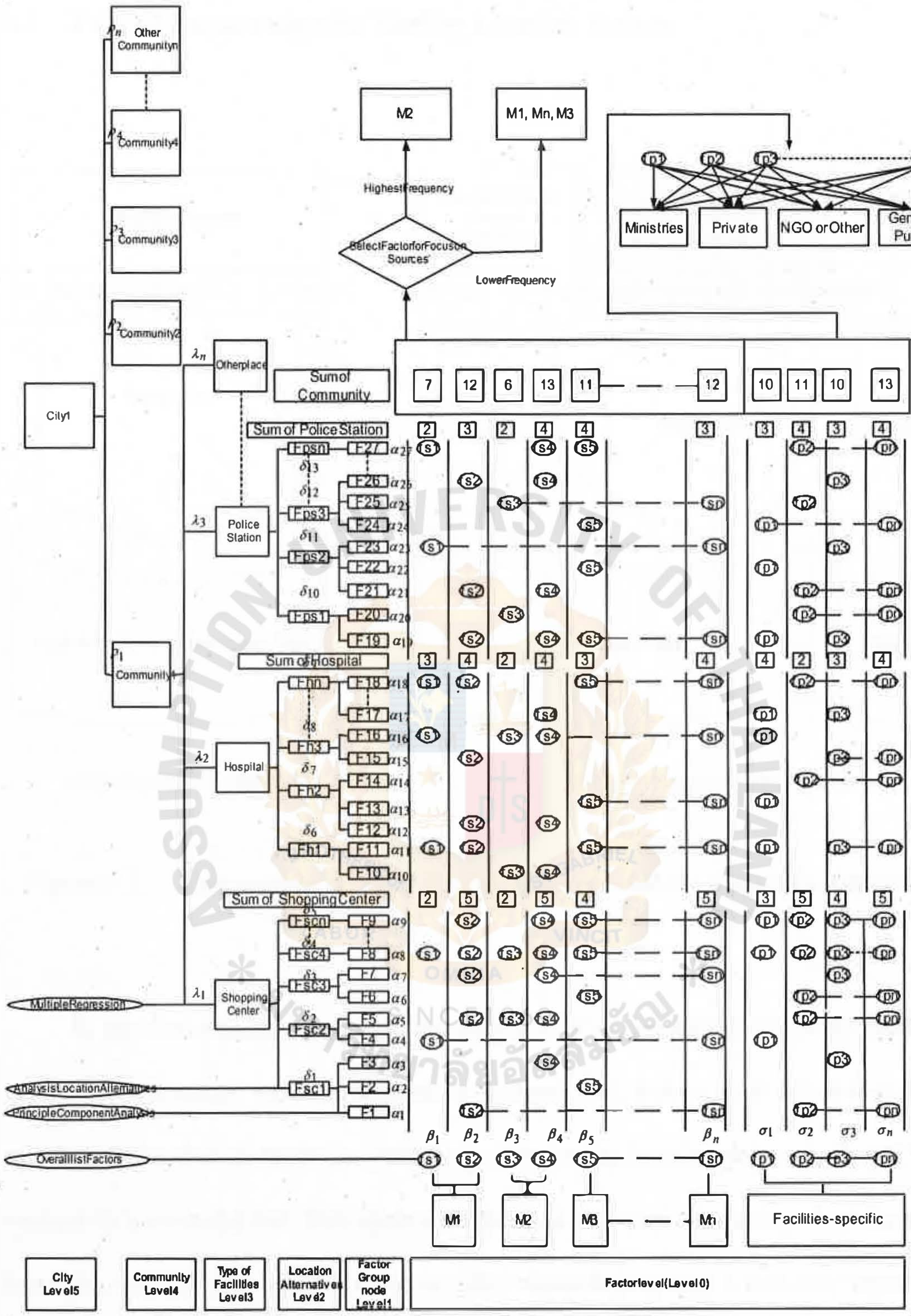

Figure 3.2. Managing Facility Network Data by Decision Tree.

3.2 Two-way Approaches for Facility Location Factors

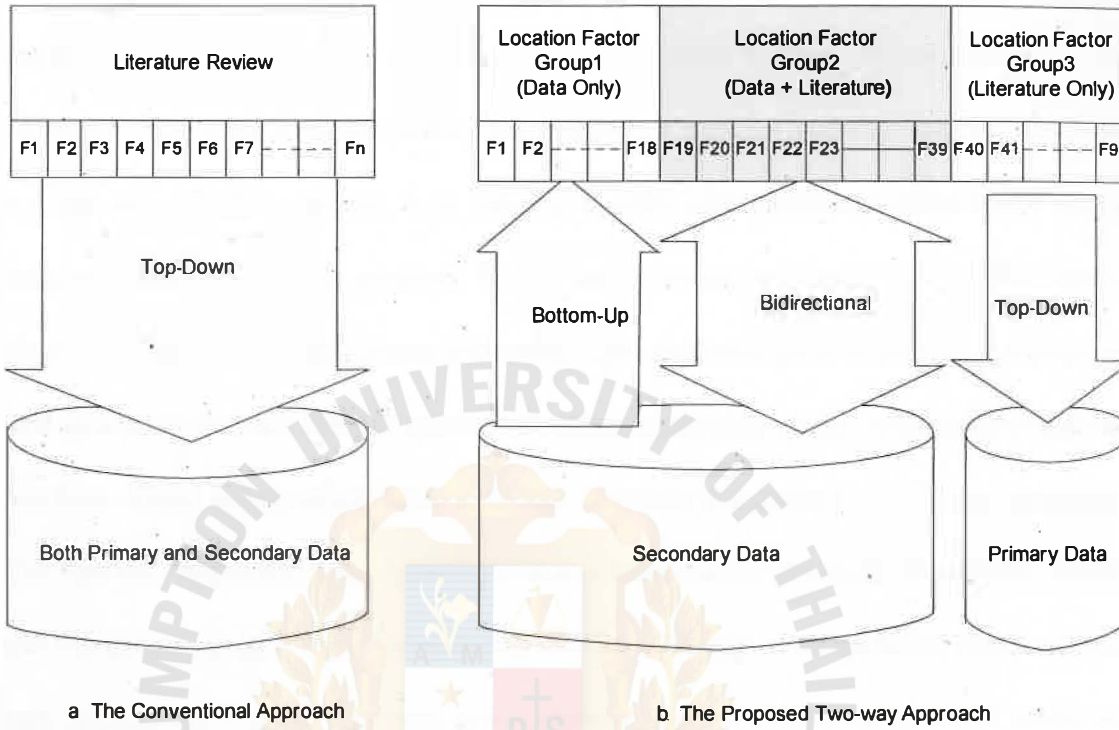

Figure 3.3. Comparison between the Conventional and the Two-way Approaches.

In the conventional approach, the selection of an appropriate location model that is able to best satisfy research objectives is done first, before a set of location factors relevant to the chosen model is identified. Afterwards, location data is gathered for the various factors on the list. This approach utilizes a one-way approach, where factors are listed and data then compiled; however, this research proposes a two-way approach to analyze retail location factors used in decision making. The methodology described is shown in Figure 3.3b.

Step 1 is the initial bottom-up stage, where an attempt to gather exhaustive location-related information from public, private, government, and non-government organizations gets underway. The accuracy and timeliness of data is confirmed through website searches supplemented by contacts and interviews. The data is then analyzed to find any location factors that may be represented, resulting in a sizable location database compiled from all available secondary sources. One of the advantages to taking the time to do this step is the development of a comprehensive location database for any site-selection project, thus helping to eliminate redundant effort when doing data searches for different projects. In addition, a single database ensures that data is kept in a single convenient place; this saves time and costs as it eliminates the need to find information from several sources. Another advantage is the confirmation that all location-related information from available secondary sources has all been gathered. The one-way approach does, however, have a weakness in that there tends to be a bias toward gathering date only for selected factors, although data gathered from various web searches and direct contacts could represent site selection factors that were not included for consideration. If any of the overlooked factors turn out to be significant, their absence reduces the credibility of the research result. This step is the opposite of the conventional method of compiling data and then listing factors.

Step 2 is the top-down stage and requires a thorough literature review for relevant location factors, in order to establish a comprehensive list. Extensiveness of the location factors is assured through a thorough investigation with the supplementary factors obtained in step one with the ones compiled from published sources, when location data for the factors can be collected. Step 2 resembles the conventional method, although the two steps described could be viewed as a two-way approach, with data to factors and factors to data. The location factors obtained through the two-way approach can be categorized in the following groups:

Group 1: Location factors identified from location data only

Group 2: Location factors identified from both location data and literature

Group 3: Location factors identified from literature only

Figure 3b depicts these three location factor groups. The factors in groups 1 and 2 are obtained during the bottom-up stage in the two-way approach, representing location factors with available location data, while factors in groups 2 and 3 are identified through the top-down stage in the two-way approach. With factors similar to those in group 1, group 2 consists of factors with readily available data. Group 3, on the other hand, consists of factors cited in literature with unavailable location data – it is therefore the only group that needs primary data to support it, which can be obtained through numerous survey instruments. The two-way approach therefore ensures the development of a single, comprehensive location factor database for site selection projects.

3.3 Stage of Implementation

There are a total of four stages in the analysis process, as follows: collecting secondary data; surveying primary data; reducing retail location factors; and confirming factor analysis.

In the first stage, all available location factors from government, non-government, and private sectors were researched, including 19 ministries and numerous journals and books, then cited in the literature review. Because the location factors were not yet specified as retail location factors, the factor list was evaluated for relevance with retail location through peer reviews. This particular stage is the bottom-up way of finding available data.

During the second stage, a questionnaire was created based on the retail location factors obtained in the first stage. The research population consisted of retail business owners who decided upon a certain shopping center in Bangkok in which to open their business. It was mentioned earlier that Alerk and Settle (1995) disputed the logic that sample size was dependent upon population size, while Weisberg and Bowen (1977) provided a table of maximum sampling errors related to the sample size for simple, randomly selected samples. Table. 3.1, based on Weisberg and Bowen (1977), is presented below:

Table 3.1. Maximum Sampling Errors for Samples of Varying Sizes.

Sample Size	Error
100	10.3
200	7.2
300	5.8
400	5.0
500	4.5
600	4.1
700	3.8
750	3.6
1,000	3.2
1,500	2.6
2,000	2.2

Although Krejcie and Morgan (1970) created a table for determining sample size, the errors calculated from the sample size was not done by using that particular table.

Required sample size, given a finite population, Where N = Population Size

n = Sample Size

The way to determine sample size from formula as:

$$n = \frac{Z^2}{4E^2}$$

Where n = the sample size to calculate, Z = value read from Z table and E = the degree of error that is allowed.

The amount of the sample size population that could not be counted may be calculated by, for example, having a 95% confidence level with a 5% level of error, and the number divided by 2 into sigma. The result would be $Z_{0.975}$ =1.96 from Z table and E = 0.05. The values are then substituted into the formula to get the sample size:

$$n = \frac{1.96^2}{4(0.05)^2} = 384.16$$

A questionnaire was conducted to confirm factor validity, targeting business people who owned retail outlets in any Bangkok shopping center. The questionnaire was divided into 2 sections, with demographic data and impact factors that influenced the selection of the shopping center. The summary of the variables are shown in Table 3.2.

A Likert scale with weights from 1-5 was applied, with 1 being "extremely low extent," 2 being "somewhat low extent," 3 being "neutral," 4 being "fairly high extent," and 5 being "extremely high extent." The survey was done to ensure that the factors were significantly applicable to the retail industry.

Table 3.2. Summary of Variable Items in Retail Location.

No.	Items	No.	Items
1	Traffic congestion	26	Construction costs
2	Number of bus stops	27	Land costs
3	Number of bus lines	28	Investment capitals
4	Modes of transportation	29	Currency exchange rate
5	Proximity to the shopping center	30	Phone/internet services
6	Number of shortcut routes	31	Utilities
7	Number of routes to shopping center	32	Quality of water
8	Number of traffic lanes	33	Available parking space
9	Type of road surface	34	Available restrooms
10	Labor quality	35	Ventilation system
11	Labor supply	36	Air pollution
12	Labor skills	37	Noise pollution
13	Labor attitude	38	Flood
14	Number of business services	39	Regulation matters
15	Proximity to head office	40	Regime
16	Proximity to suppliers	41	Government policies
17	Household income and expenditure	42	Taxes
18	Gross domestic product (GDP)	43	Used product shops
19	Number businesses, closures, and existence	44	Massage parlor
20	Import and export rate	45	Hotels
21	Inflation rate	46	Education institutions
22	Interest rate	47	Parks and recreational facilities
23	Product price change	48	Governmental organizations
24	Research/operations expenditure	49	Community seat
25	Rental costs	50	Libraries

Table 3.2. Summary of Variable Items in Retail Location. (Cont.).

No.	Items	No.	Items
51	Fire stations	74	Amount of sales in the area
52	Foundations	75	Product variety
53	Post offices	76	Population
54	Police stations	77	Immigration/emigration rate
55	Religious facilities (temples, churches)	78	Community attitude
56	Fresh markets	79	Size of shopping center
57	Drug stores	80	Design/decoration
58	Restaurants/ cafeteria	81	Location within shopping center
59	Nearby shopping centers	82	Expand space
60	Hospitals	83	Type of ownership (rent, own, or lease)
61	Banks	84	Zoning
62	Minimarts	85	Security around shopping center
63	Industrial area	86	Management (strategies and policies)
64	Warehouse, godown	87	Local culture
65	Sports facilities	88	Local languages
66	Entertainment complex	89	Race/nationality
67	Insurance company	90	Fengshui
68	Concert exhibition halls	91	Technology changes
69	Nearby shopping centers	92	Fashion trend
70	Airports	93	Advertising media
71	Gas stations	94	War/revolution
72	Purchasing behavior	95	Terrorism
73	Response of customer to new shopping center		

To determine the questionnaire reliability, a pretest was launched with a sample size of 30 storeowners. After confirming reliability, a post-test was initiated, with the survey population including any retail stores, either registered with the Ministry of Commerce or unregistered. The respondents of the questionnaire were business owners who decided to open their shops in shopping centers, including those who owned a gold shop, photo shop, DVD and VCD shop, optical shop, pharmacy store, spa, computer shop, sport shop, camping shop, language institution, furniture shop, jewelry, book store, radio shop, lamp shop, kid shop, game shop, mobile shop, electronics shop, cloth shop, gift shop, cosmetics shop, hair and beauty shop, trading shop, picture and frame shop, toy shop, internet shop, watch shop, shoe shop, dentist shop, studio, food and restaurant, and home mart. The researcher spent some time explaining the meaning of each factor so that the respondents clearly understood the meaning of the factors. Each respondent spent about 20-25 minutes filling in the questionnaire.

The questionnaire was launched during the morning on working days, as this was the time that respondents had sufficient time to fill in the questionnaires. Anyone who is not the owner of a shop and did not decide the shop location would be screened out. In the end, a total of 420 questionnaires were usable, which was well over the requirement of 385 sets for an uncountable population at a 95% confidence interval.

Because the total population is unknown, a table showcasing maximum sampling error relating to sample size for simple, randomly selected samples was adopted in order to determine the sample size, as shown in Table 3.3.

The third stage consisted of reducing the number of retail location factors through the use of SPSS 12.0. The principal component analysis (PCA) reduction technique was applied. Factors were ranked based on their average score, and a factor with a

Table 3.3. Required Sample Size in Given Populations.

N-n	N-n	N-n	N-n	N-n
10-10	100-80	280-162	800-260	2800-338
15-14	110-86	290-165	850-265	3000-341
20-19	120-92	300-169	900-269	3500-346
25-24	130-97	320-175	950-274	4000-351
30-28	140-103	340-181	1000-278	4500-354
35-32	150-108	360-186	1100-285	5000-357
40-36	160-113	380-191	1200-291	6000-361
45-40	170-118	400-196	1300-297	7000-364
50-44	180-123	420-201	1400-302	8000-367
55-48	190-127	440-205	1500-306	9000-368
60-52	200-132	460-210	1600-310	10000-370
65-56	210-136	480-241	1700-313	15000-375
70-59	220-140	500-217	1800-317	20000-377
75-63	230-144	550-226	1900-320	30000-379
80-66	240-148	600-234	2000-322	40000-380
85-70	250-152	650-242	2200-327	50000-381
90-73	260-155	700-248	2400-331	75000-382
95-76	270-159	750-254	2600-335	100000-384

mean value less than 3.0 was eliminated. The total variance was also expressed, and the research verified the factor grouping through eigenvalues equal or greater than 1 (Hair et al, 1992). Each group factor was tested for reliability, and a Varimax rotational approach was utilized to maximize the required loading variance sum for the factor matrix, achieving a simpler and theoretically more meaningful factor solution. In addition, each group must have at least three items within their group; otherwise, they are ignored.

Table 3.4. Criteria for Factor Grouping.

Criteria	Suggested Value
Mean	Above average
Factor Loading	0.3 to 1.0
Group Eigenvalue	1.0 or more
Number of factors in the group	At least 3

During the fourth stage, AMOS 5.0 was used to develop a structural equation model that was subsequently validated by the confirmatory factor analysis (CFA), which confirmed factor groups from the previous stage. Because some factor groups may have numerous items, the author applied the item parcels technique in order to combine the variables into subgroups that would enhance the model fit, using the structural equation modeling (SEM) process. The parcel scores were used in the latent variable analysis (Russel and Taylor, 1998).

Before the implementation stage, a preliminary identification of relevant location factors and subsequent data collection must be done, with the methodology process a part of site selection in urban planning. In order to choose the best location, completeness and accuracy of location data, including user requirements and location factors, must be known. User requirements generally differ from project to project, obtained from location users such as those in top management, middle management, or the operators in a relatively short time period. Gathering data on location factors, however, is much more time consuming and if the completeness and accuracy of the location data is not confirmed, the suitability of a selected site would be questionable. The research methodology does not function only for urban planning, as it has numerous facility functions that can be combined and analyzed to set the location database. It can be developed into a decision support system for site selection that would be useful in top management analysis, for example.

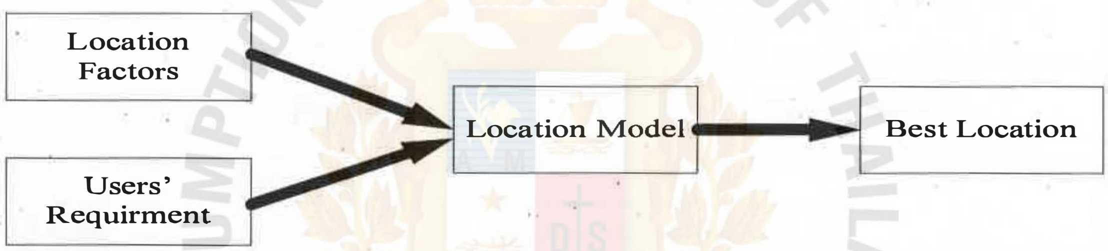

Figure 3.4. Three Components of Location Decisions.

Through accumulating vast amounts of primary and secondary data, this research study attempted to compile a comprehensive list of location factors. Data sources included literature and websites that were published by both private and public sectors. To manage such a huge amount of information, the research was limited in scope, focusing only on retail location factors in Bangkok, validating the obtained retail location factors, and confirming the significance and homogeneity for each factor group.

IV. RATIFICATION OF RETAIL LOCATION FACTORS

In this chapter, the researcher will proceed to explain the data analysis details processed by listing the general location factors from both secondary and primary data, the location screening factors and retail location factors through peer review, the reliability testing of data, data reduction through the use of factor analysis, and the construction of critical retail location factors by using a structural equation model in AMOS. Location factors can be analyzed in a systematic way through a hierarchical method, as shown in Figure 4.1.

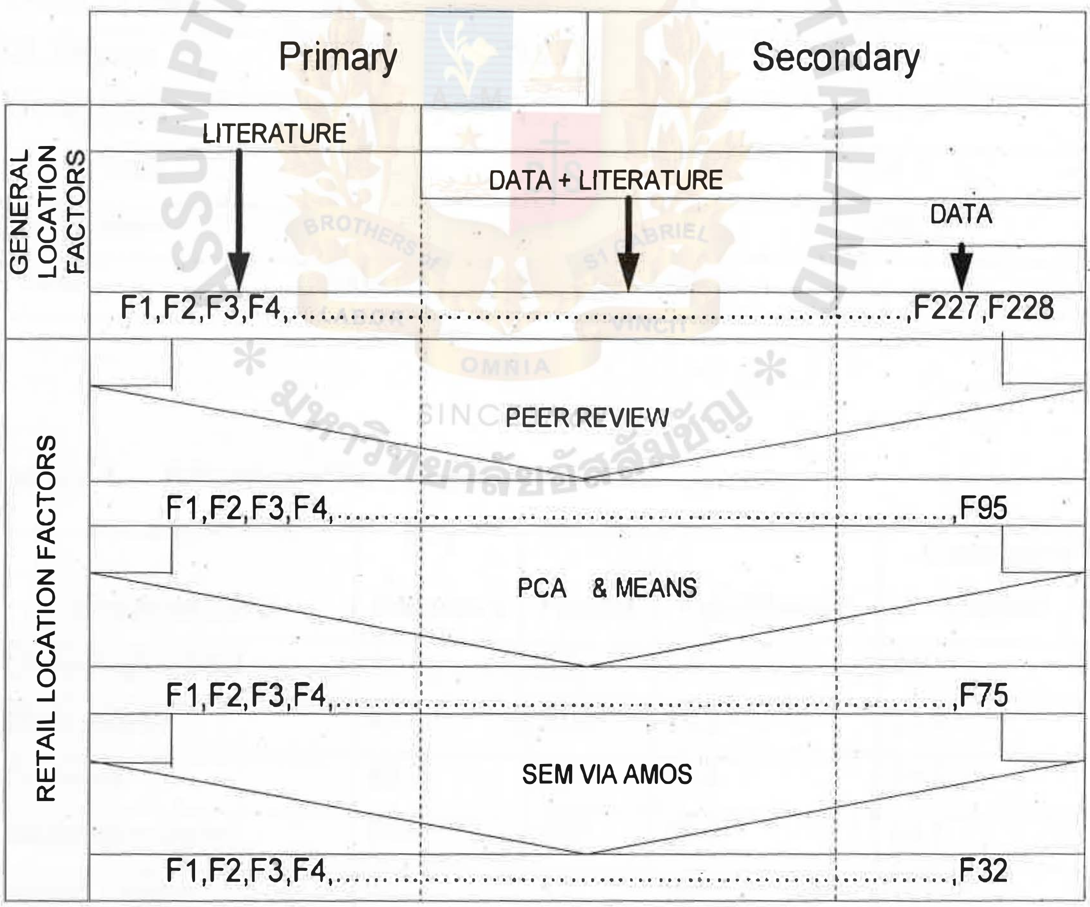

Figure 4.1. A Hierarchical Approach to Retail Location Factor Ratification.

4.1 Descriptive Statistics of Participants

This section presents the details of demographic data that were obtained from the survey questionnaire. In regards to the age of participants who go to shopping centers, the largest age groups are those aged from 31 to 40 years. In addition, 68.1% of respondents are 25 to 40 years old, with the highest frequency for making decisions regarding the selection of investment places.

Table 4.1. Age of Participants.

Age	Frequency	Percent	Valid Percent	Cumulative Percent
Under 25 years	31	7.4	7.4	7.4
25-30 years	104	24.8	24.8	32.1
31-40 years	182	43.3	43.3	75.5
41-50 years	83	19.8	19.8	95.2
51-60 years	20	4.8	4.8	100.0
Total	420	100.0	100.0	

Table 4.2. Education of Participants.

Education Level	Frequency	Percent	Valid Percent	Cumulative Percent
Under high school	11	2.6	2.6	2.6
High school	43	10.2	10.2	12.9
Diploma	52	12.4	12.4	25.2
Bachelor's degree	290	69.0	69.0	94.3
Master Degree	24	5.7	5.7	100.0
Total	420	100.0	100.0	

Regarding education, the majority of respondents (or 69%) are those who have earned a bachelor's degree, indicating that the retail location decision is influenced by those who hold a bachelor's degree. In addition, 61.2% of respondents were male, which may be interpreted that males are still the majority of those who make business decisions about retail location, rather than females.

Table 4.3. Gender of Participants.

Gender	Frequency	Percent	Valid Percent	Cumulative Percent
Male	257	61.2	61.2	61.2
Female	163	38.8	38.8	100.0
Total	420	100.0	100.0	

4.2 Retail Location Factor Analysis

The steps used in factor analysis have been mentioned in a previous chapter. Here is a brief explanation for each of the factor analysis steps:

(1) Rank based on average scores; those with means less than 3.0 are screened out.

(2) Perform the Bartlett test of sphericity to evaluate correlation matrix factors.

(3) Calculate the Kaiser-Meyer-Olkin Measure of Sampling Adequacy.

(4) Because communalities represent a fraction of the total variance accounted for by variables, calculating communalities means there is a way to keep track of how much the original variance contained in variables is accounted for by the number of factors that have been retained.

(5) Conduct principal components analysis in order to group relevant and homogeneous factors, with factor groups that have an Eigenvalue less than one discarded.

(6) Initial eigenvalues are obtained.

(7) The total variance is explained, with components by the extraction sums of the squared loadings and rotation sums of squared loadings, as shown in the Table that follows.

(8) The graph of Scree plot shows the relationship between eigenvalues and the number of components, which is subject to elimination.

(9) The component matrix is checked.

(10) Factor rotation reorganizes the loadings onto rotated factors. By using Varimax with the Kaiser Normalization Method, the rotations are converged in several iterations until the increase in the overall variance drops below a preset value.

The results of the 10 steps will be explained in this section, with the researcher illustrating the factor analysis of 95 retail location variables and compiled location factors from 270 websites, 127 papers, and 12 books, which resulted in 95 retail location factors. The relevance of the factor to retail location decisions was confirmed through comparison. Among the 95 factors, 20 had means that were at or below 3.0 and thus would be screened out, leaving 75 factors remaining. Then, from the confirmed factor analysis, the researcher ranked priorities from highest to lowest contributions.

Table 4.4. Descriptive Statistics of 95 Retail Location Factors.

Retail Location Factors	N	Mean	Std. Deviation	Variance
Investment capital	420	4.45	.744	.553
Rental cost	420	4.29	.754	.568
Purchasing behavior	420	4.27	.836	.699
Security around shopping mall	420	4.26	.926	.858
Location within shopping mall	420	4.25	.867	.751
Traffic congestion	420	4.15	.838	.702
Sales trend in the area	420	4.14	.833	.694
Average monthly household income and expenditure of each family	420	4.14	.795	.632
Advertising media, e.g. posters, TV, radio	420	4.12	.926	.858
Construction/decoration costs	420	4.12	.895	.800
Parking space within shopping mall	420	4.11	.856	.733
Product variety	420	4.06	.865	.748
No. of bus lines	420	4.05	.857	.734
Community seat	420	4.04	.987	.975
Restrooms of shopping mall	420	4.03	.903	.815
Modes of transportation	420	4.00	.812	.659
Labor skills	420	3.97	.827	.684
Proximity to shopping centers	420	3.96	.875	.765
Nearby shopping mall	420	3.96	.930	.865
Competitors around shopping mall	420	3.95	.979	.959
Design/decoration	420	3.92	.973	.946
Population	420	3.91	.908	.825
Size of shopping mall	420	3.91	.918	.843
Technology change	420	3.89	.968	.937
Labor supply	420	3.88	.866	.750
Ventilation within shopping mall	420	3.88	.863	.745
Entertainment complex	420	3.88	1.113	1.238
Noise pollution	420	3.85	1.001	1.003

Table 4.4. Descriptive Statistics of 95 Retail Location Factors. (Cont 1)

Retail Location Factors	N	Mean	Std. Deviation	Variance
Bus stops	420	3.83	.914	.836
Interest rate	420	3.82	.961	.924
Land cost	420	3.82	1.018	1.036
Labor quality	420	3.81	.875	.766
Zoning	420	3.80	.890	.792
Air pollution	420	3.80	1.002	1.003
Fashion trend	420	3.79	1.051	1.105
Labor attitude	420	3.78	.925	.855
Taxes	420	3.77	.888	.788
Quality of water and sewage treatment system	420	3.74	.914	.835
Concert exhibition halls	420	3.73	1.185	1.405
No. of routes to shopping center	420	3.73	.948	.899
Government policies	420	3.70	1.047	1.095
Regulatory matters (investment promotion, other legal services)	420	3.69	.922	.851
Education institutions	420	3.68	1.162	1.351
Utilities	420	3.67	.958	.917
Phone/Internet services	420	3.66	1.101	1.213
Gross Domestic Product (GDP)	420	3.65	.863	.744
Import and export rate	420	3.62	1.100	1.209
Type of ownership (rent, own, lease)	420	3.58	.960	.921
Expansion space	420	3.57	1.021	1.043
Banks	420	3.56	1.105	1.220
Inflation rate	420	3.53	1.060	1.123
Shortcut routes	420	3.53	.992	.985
Business services	420	3.51	.889	.790
Restaurants/cafeteria	420	3.50	1.147	1.315
Research/operations expenditure	420	3.49	1.080	1.167

Table 4.4. Descriptive Statistics of 95 Retail Location Factors. (Cont 2)

Retail Location Factors	N	Mean	Std. Deviation	Variance
Proximity to sources of goods and materials	420	3.48	1.157	1.339
Community attitude	420	3.46	1.037	1.075
Currency exchange rate	420	3.45	1.020	1.040
Used products shops	420	3.44	.957	.915
No. of lanes	420	3.42	1.053	1.109
No. businesses, closures, and existence	420	3.36	1.004	1.008
Proximity to head office	420	3.30	1.021	1.043
Parks and recreation facilities	420	3.22	1.113	1.239
Flood	420	3.22	1.322	1.747
Regime	420	3.20	1.093	1.195
Governmental organizations	420	3.10	.987	.974
Hospitals	420	3.08	1.021	1.042
Police stations	420	3.00	1.116	1.246
Terrorism	420	2.98	1.590	2.529
War/ revolution	420	2.96	1.504	2.261
Hotels	420	2.90	1.240	1.537
Industrial area	420	2.90	1.268	1.607
Post offices	420	2.89	1.131	1.279
Mini marts	420	2.82	1.221	1.491
Sport club, Gymnasium	420	2.81	1.043	1.087
Drug stores	420	2.78	1.105	1.222
Warehouse, godown	420	2.77	1.183	1.399
Local culture	420	2.74	.971	.942
Local language	420	2.71	1.083	1.174
Fire stations	420	2.70	1.130	1.278
Race/nationality	420	2.70	1.085	1.177
Libraries	420	2.67	1.235	1.524
Insurance companies	420	2.67	1.058	1.120

Table 4.4. Descriptive Statistics of 95 Retail Location Factors. (Cont 3)

Retail Location Factors	N	Mean	Std. Deviation	Variance
Airports	420	2.57	1.262	1.592
Gas stations/ Petrol stations	420	2.55	.967	.936
Massage parlor	420	2.49	1.115	1.243
Religious facilities (Temple, church)	420	2.44	1.122	1.258
Foundations	420	2.32	1.084	1.174

The retail location factor results were then reduced using data reduction methodology, and Principle Component Analysis (PCA) done through SPSS 12.0 analyzed the dimensionality of the 75 retail location factors. The PCA classified the factors into 19 groups or principal components, and a component factor analysis showed that these 19 principal components accounted for 67.52% of the variance as shown in Table 4.7. Because it was difficult to generate definitions and meanings for the factors from the unrotated pattern, the researcher applied the commonly used orthogonal rotation method. The syntax for the calculation output of the rotation variables from p3_1_1 to p3_9_24, (Appendix A), k in factor loading from 0.33 by varimax rotation method is shown as:

factor variables=p3_1_1 to p3_9_24/format=sort blank(0.33)/

plot=eigen/extraction=pc/rotation=varimax.

The Varimax with Kaiser Normalization KMO measure of sampling adequacy equaled 0.88, with up to 19 factor groups (as shown in Table 4.5). All 19 groups had eigenvalues greater than 1, indicating group stability, while the loadings of factors were modest to high (0.33 – 0.84), indicating stability of the factors (Girden, 1996). Descriptive phrases were created for categories representing the rotated factor loading, which came from data gathered through the original questionnaire. The criteria for factor loading significance can be seen in Hair et al. (1998), where it is suggested that when the sample size is 100 or larger, factor loadings greater than ± 0.30 are considered to meet the minimal level; loadings of ± 0.40 are considered more important; and loading of ± 0.50 or greater are considered of practical significance. Therefore, the larger the absolute size of the factor loading, the more important the loading is in interpreting the factor matrix. The loadings on the factors in this research are modest to high (0.33-0.84).

Table 4.5. KMO and Bartlett's Test of 75 Retail Location Factors.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.882
Bartlett's Test of Sphericity	Approx. Chi-Square	16211.861
	df	2775
	Sig.	0.000

Table 4.6. Communalities of 75 Retail Location Factors.

Retail Location Factors	Initial	Extraction
Traffic congestion	1.000	.588
Bus stops	1.000	.675
No. of bus lines	1.000	.623
Modes of transportation	1.000	.644
Proximity to shopping centers	1.000	.647
Shortcut routes	1.000	.671
No. of routes to shopping center	1.000	.619
No. of lanes	1.000	.655
Types of road surface	1.000	.690
Labor quality	1.000	.645
Labor supply	1.000	.694

Table 4.6. Communalities of 75 Retail Location Factors. (Cont 1)

Retail Location Factors	Initial	Extraction
Labor skills	1.000	.678
Labor attitude	1.000	.648
Business services	1.000	.725
Proximity to head office	1.000	.707
Proximity to sources of goods and materials	1.000	.687
Average monthly household income and expenditure of each family	1.000	.665
GDP	1.000	.681
No. businesses, closures, and existence	1.000	.676
Import and export rate	1.000	.740
Inflation rate	1.000	.727
Interest rate	1.000	.619
Product price change	1.000	.657
Research/operations expenditure	1.000	.573
Rental cost	1.000	.749
Construction/decoration costs	1.000	.706
Land cost	1.000	668
Investment capital	1.000	.593
Currency exchange rate	1.000	.636
Phone/Internet services	1.000	.761
Utilities	1.000	.773
Quality of water and sewage treatment system	1.000	.718
Parking space within shopping mall	1.000	.618
Restrooms of shopping mall	1.000	.720
Ventilation within shopping mall	1.000	.655
Air pollution	1.000	.759
Noise pollution	1.000	.783
Flood	1.000	.745
Regulatory matters (investment promotion, other legal services)	1.000	.716

Table 4.6. Communalities of 75 Retail Location Factors. (Cont 2)

Retail Location Factors	Initial	Extraction
Regime	1.000	.772
Government policies	1.000	.778
Taxes	1.000	.648
Used products shops	1.000	.598
Education institutions	1.000	.669
Parks and recreation facilities	1.000	.651
Governmental organizations	1.000	.711
Community seat	1.000	.634
Police stations	1.000	.646
Fresh markets	1.000	.629
Restaurants /cafeteria	1.000	.666
Nearby shopping mall	1.000	.648
Hospitals	1.000	.683
Banks	1.000	.669
Entertainment complex	1.000	.643
Concert exhibition halls	1.000	.661
Competitors around shopping mall	1.000	.651
Purchasing behavior	1.000	.646
Consumer's response to new shopping mall	1.000	.619
Sales trend in the area	1.000	.645
Product variety	1.000	.608
Population	1.000	.761
Immigration/ emigration rate	1.000	.612
Community attitude	1.000	.582
Size of shopping mall	1.000	.697

Table 4.6. Communalities of 75 Retail Location Factors. (Cont 3)

Retail Location Factors	Initial	Extraction
Design/decoration	1.000	.751
Location within shopping mall	1.000	.638
Expansion space	1.000	.749
Type of ownership (rent, own, lease)	1.000	.754
Zoning	1.000	.600
Security around shopping mall	1.000	.678
Management	1.000	.677
Fengshui	1.000	.664
Technology change	1.000	.704
Fashion trend	1.000	.677
Advertising media, e.g. posters, TV, radio, etc.	1.000	.690

Extraction Method: Principal Component Analysis.

Table 4.7. Total Variance Explained of 75 Retail Location Factors.

Component	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	15.268	20.357	20.357
2	5.422	7.229	27.586
3	4.023	5.364	32.950
4	2.907	3.876	36.827
5	2.654	3.538	40.365
6	2.311	3.081	43.446
7	2.092	2.789	46.235
8	1.767	2.357	48.591
9	1.700	2.266	50.858
10	1.600	2.133	52.991

Table 4.7. Total Variance Explained of 75 Retail Location Factors. (Cont 1).

Component	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
11	1.473	1.963	54.954
12	1.438	1.917	56.871
13	1.302	1.735	58.607
14	1.234	1.646	60.253
15	1.159	1.545	61.798
16	1.127	1.503	63.301
17	1.079	1.439	64.739
18	1.058	1.410	66.149
19	1.028	1.371	67.520
20	.972	1.296	68.817
21	.887	1.182	69.999
22	.860	1.147	71.146
23	.829	1.105	72.250
24	.800	1.067	73.317
25	.790	1.053	74.371
26	.759	1.011	75.382
27	.726	.967	76.350
28	.713	.951	77.300
29	.682	.909	78.209
30	.656	.875	79.084
31	.643	.857	79.941
32	.618	.825	80.765
33	.606	.807	81.573
34	.585	.780	82.352
35	.546	.728	83.080
36	.541	.722	83.802
37	.517	.689	84.491
38	.509	.679	85.170
39	.482	.643	85.813
40	.480	.639	86.452

Table 4.7. Total Variance Explained of 75 Retail Location Factors. (Cont 2)

Component	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
41	.463	.617	87.070
42	.445	.593	87.663
43	.434	.578	88.241
44	.430	.574	88.815
45	.417	.556	89.370
46	.396	.528	89.898
47	.389	.519	90.417
48	.381	.509	90.926
49	.374	.499	91.425
50	.367	.490	91.914
51	.338	.451	92.365
52	.330	.440	92.805
53	.326	.435	93.239
54	.315	.419	93.659
55	.310	.413	94.072
56	.300	.400	94.472
57	.290	.387	94.859
58	.286	.381	95.240
59	.281	.374	95.614
60	.265	.354	95.968
61	.261	.348	96.316
62	.249	.332	96.648
63	.245	.326	96.974
64	.240	.320	97.294
65	.233	.310	97.604
66	.222	.296	97.900
67	.215	.287	98.187
68	.208	.277	98.464
69	.194	.259	98.723

Table 4.7. Total Variance Explained of 75 Retail Location Factors. (Cont 3)

Component	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
70	.188	.251	98.974
71	.177	.237	99.211
72	.163	.217	99.428
73	.151	.201	99.629
74	.143	.191	99.821
75	.135	.179	100.000

Extraction Method: Principal Component Analysis.

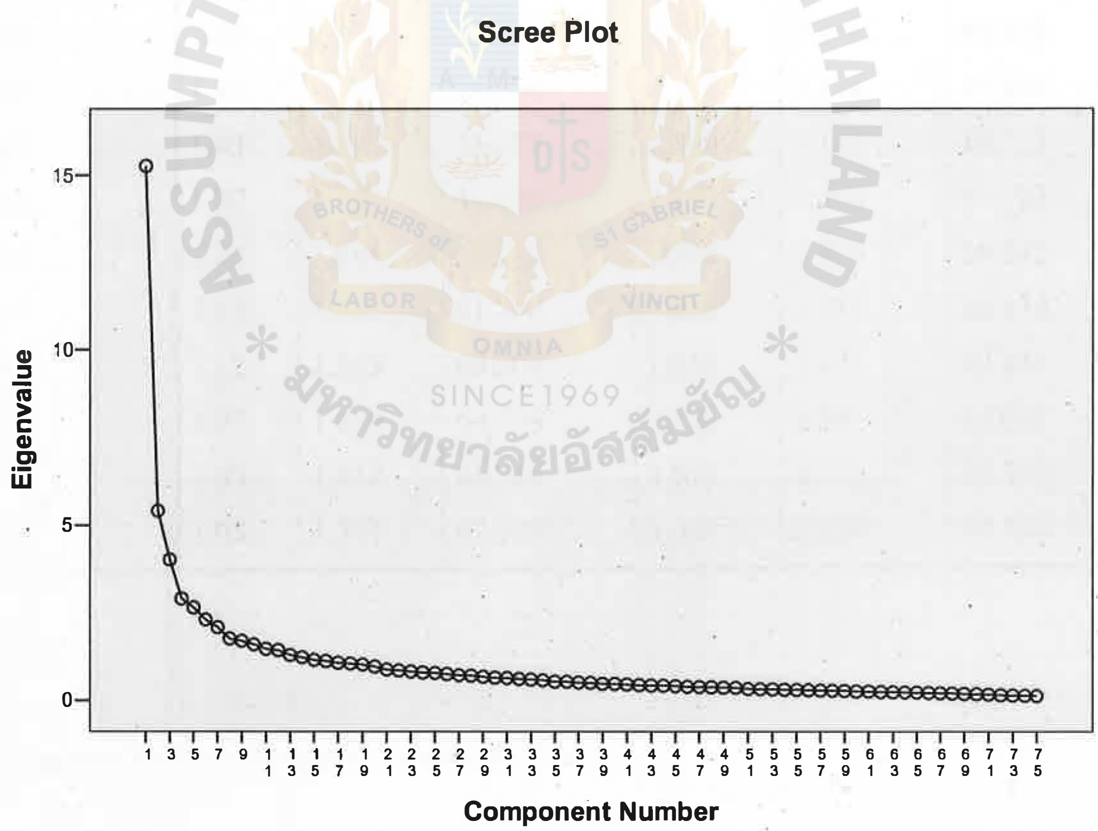

Figure 4.2. Scree Plot of Retail Location Factors.

Table 4.8. Total Variance Explained of 75 Retail Location Factors Sums of Squared.

Component	Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	15.26	20.357	20.357	5.226	6.969	6.969
2	5.42	7.229	27.586	4.756	6.341	13.310
3	4.02	5.364	32.950	4.156	5.542	18.852
4	2.90	3.876	36.827	3.062	4.082	22.934
5	2.65	3.538	40.365	2.938	3.917	26.851
6	2.31	3.081	43.446	2.758	3.677	30.528
7	2.09	2.789	46.235	2.649	3.532	34.060
8	1.77	2.357	48.591	2.556	3.407	37.467
9	1.70	2.266	50.858	2.462	3.283	40.750
10	1.60	2.133	52.991	2.460	3.280	44.031
11	1.47	1.963	54.954	2.395	3.194	47.224
12	1.43	1.917	56.871	2.369	3.158	50.383
13	1.30	1.735	58.607	2.250	3.000	53.383
14	1.23	1.646	60.253	1.919	2.559	55.942
15	1.15	1.545	61.798	1.899	2.532	58.474
16	1.12	1.503	63.301	1.853	2.471	60.945
17	1.07	1.439	64.739	1.722	2.297	63.241
18	1.05	1.410	66.149	1.616	2.155	65.396
19	1.03	1.371	67.520	1.593	2.124	67.520

Extraction Method: Principal Component Analysis.

Table 4.9. Rotated Component Matrix of Retail Location Factors.

Retail Location factors	Component				
	1	2	3	4	5
Police stations	.730				
Banks	.724				
Governmental organizations	.720				
Hospitals	.688				
Education institutions	.682				
Parks and recreation facilities	.681				
Entertainment complex	.598				
Concert exhibition halls	.534				
Restaurants/cafeteria	.516				
Community seat	.505				
Import and export rate		.723			
GDP		.669			
No. businesses, closures, and existence		.647			
Inflation rate		.645			
Average monthly household income and expenditure		.545			
Flood		.530			
Interest rate		.515			
Immigration/ emigration rate		.425			
Purchasing behavior		.390			
Research/operations expenditure		.335			
Proximity to shopping centers			.707		
Shortcut routes			.703		
No. of routes to shopping center			.678		
Bus stops			.676		
Modes of transportation			.618		
No. of bus lines			.576		
Traffic congestion			.505		

Table 4.9. Rotated Component Matrix of Retail Location Factors. (Cont.1)

Retail Location factors	Component				
	4	5	6	7	8
Regime	.723				
Regulatory matters (investment promotion, other legal services)	.717				
Government policies	.714				
Taxes	.683				
Currency exchange rate	.352				
Management		.727			
Security around shopping mall		.607			
Product price change		.558			
Location within shopping mall		.513			
Utilities			.841		
Phone/Internet services			.755		
Quality of water and sewage treatment system			.686		
Parking space within shopping mall			.410		
Labor supply				.721	
Labor skills				.687	
Labor quality				.612	
Labor attitude				.415	
Community attitude				.351	
Noise pollution					.809
Air pollution					.773
Ventilation within shopping mall					.359

Table 4.9. Rotated Component Matrix of Retail Location Factors. (Cont.2)

Retail Location factors	Component							
	9	10	11	12	13	14	15	16
Advertising media	0.77							
Fashion trend	0.72							
Used products shops	0.33							
Nearby shopping mall		0.69						
Shopping mall competitors		0.69						
Population			0.72					
Product variety			0.54					
Sales trend in the area			0.49					
Consumers' response to new shopping mall			0.48					
Fresh markets			0.45					
Type of ownership (Rent, own, lease)				0.77				
Expansion space				0.70				
Rental cost					0.78			
Construction/decoration costs					0.76			
Investment capital					0.48			
Land cost					0.43			
Business services						0.75		
Proximity to head office						0.54		
Proximity to sources of goods and materials						0.52		
Design/decoration							0.72	
Size of shopping mall							0.57	
Types of road surface								0.58
No. Of lanes								0.49

Table 4.9. Rotated Component Matrix of Retail Location Factors. (Cont.3)

Retail Location factors	Component		
	17	18	19
Zoning	0.603		
Fengshui		0.674	
Technology change		0.512	
Restrooms of shopping mall			0.598

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

A Rotation converged in 24 iterations.

The scree plot is a graph used to determine the number of factors. The eigenvalues are plotted in the sequence of the principle factors, and the number of factors is chosen where the plot levels off and becomes a linear decreasing pattern. Figure 4.2 showcases a scree plot for retail location factors that are not suitable for interpretation of many items. Eliminations are made by use of the eigenvalue, exactly pinpointing the retail location factors.

In this research, one interesting result was that of Group 18, which consisted of the Feng Shui man or geomancer's suggestions and local beliefs. In Chinese, "Feng Shui" literally means wind and water. This factor group represents the long-established belief that a location's appropriateness depends on its harmony with the surroundings. Although this group may not be considered much in other areas of the world, it surfaced as a significant factor group in this particular study.

4.3 Structural Equation Model of Retail Location Factors.

In the previous section, factor analysis was used to group 95 retail location factors into 19 groups. In this section, the reliability and validity of the data within this research is confirmed, with a retail location model constructed from the group of retail location factors significantly affecting decision-making. The item parcels technique was used to combine factors into subgroups and enhanced through the structural equation modeling (SEM) process through the use of scores in the parcels within the latent variable analysis (Russell and Taylor, 1998).

The alpha coefficient or coefficient alpha (Cronbach, 1947; 1951) is used as an index of the internal consistency and reliability of measures within psychological and organizational science domains. There have been many researches that have demonstrated that the alpha coefficient assumes that the assessed measure consists of a uni-dimensional set of items and that it is not an index of item homogeneity (Cortina, 1993; Green, Lissitz, and Mulaik, 1977; Hattie, 1985; Miller, 1995). The reliability analysis procedure calculates a number of commonly used measures of scale reliability, as well as provides information about the relationships between individual items in the scale, in a model of internal consistency that is based on the average inter-item correlation. These are displayed in Tables 4.10-4.13. The reliability test syntaxes in SPSS are shown below:

```
reliability variables= p3_1_1 to p3_9_24
/scale(group1)= p3_8_4 p3_8_5 p3_8_6 p3_8_7 p3_8_12 p3_8_16 p3_8_18 p3_8_19
p3_8_24 p3_8_26/summary=total.
reliability variables= p3_1_1 to p3_9_24
/scale(group2)= p3_4_1 p3_4_2 p3_4_3 p3_4_4 p3_4_5 p3_4_6 p3_4_8 p3_6_3
p3_9_1 p3_9_6/summary=total.
```

reliability variables= p3_1_1 to p3_9_24

/scale(group3)= p3_1_1 p3_1_2 p3_1_3 p3_1_4 p3_1_6 p3_1_7 p3_8_17

/summary=total.

reliability variables= p3_1_1 to p3_9_24

/scale(group4)= p3_4_13 p3_7_1 p3_7_2 p3_7_3 p3_7_4 /summary=total.

As can be seen from Tables 4.10-4.13, the reliability test results for all the constructs in the research model are at .770 - .875. This indicated that the design factors reliably responded to the constructs in the research model, since the value of Cronbach's Alpha was sufficient enough for the reliability test. Nunnaly (1978) proposed that 0.7 be used as an acceptable reliability coefficient; however, lower thresholds are sometimes used as well. The reliability tests were summarized for each retail location group in the Table 4.14.

Table 4.10. Cronbach's Alpha: Reliability Test for Group 1 of Retail Location Factor.

Item-Total Statistics

Factor	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Police station	31.78	46.698	.563	.866
Bank	31.21	45.835	.633	.860
Governmental organizations	31.68	47.973	.554	.866
Hospital	31.70	46.841	.619	.862
Education institutions	31.10	44.355	.699	.855
Parks, Recreation Facilities	31.55	46.095	.608	.862
Entertainment complex	30.90	45.718	.636	.860
Concert exhibition halls	31.05	45.850	.578	.865
Restaurants/cafeteria	31.28	47.168	.511	.870
Community seat	30.74	47.681	.577	.865

Table 4.11. Cronbach's Alpha: Reliability Test for Group 2 of Retail Location Factor.

Item-Total Statistics

Factor	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Import and export rate	32.82	34.012	.694	.817
GDP	32.80	37.526	.553	.832
No. businesses, closures, and existence	33.09	35.600	.627	.825
Inflation rate	32.91	34.260	.704	.817
Average monthly household income and expenditure of each family	32.31	38.261	.531	.835
Flood	33.23	33.289	.596	.829
Interest rate	32.62	36.827	.546	.832
Immigration/ emigration rate	33.10	36.013	.509	.836
Purchasing behavior	32.18	39.410	.382	.845
Research/operations expenditure	32.96	38.263	.351	.850

Table 4.12. Cronbach's Alpha: Reliability Test for Group 3 of Retail Location Factor.

Item-Total Statistics

Factor	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Proximity to shopping mall	23.29	13.977	.593	.787
Short cut routes	23.73	13.167	.620	.781
No. of routes to shopping mall	23.52	13.491	.607	.784
Bus stops	23.43	13.782	.589	.787
Mode of transportation	23.25	14.639	.535	.797
No. of bus lines	23.20	14.819	.465	.808
Traffic	23.10	14.803	.483	.805

Table 4.13. Cronbach's Alpha: Reliability Test for Group 4 of Retail Location Factor.

Item-Total Statistics

Factor	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Regulatory matters (investment promotion, other legal services)	14.11	8.736	.615	.705
Government policies	14.10	8.395	.569	.718
Property taxes, land taxes	14.03	9.121	.566	.722
Structure of government	14.60	7.863	.634	.693
Currency exchange rate	14.35	9.684	.350	.792

Table 4.14. Summary of the Reliability Tests—Retail Location in Each Group.

Reliability Analysis-Scale (Alpha) , Reliability Coefficients	
Constructs represent group of items tested	Alpha
Group 1	.875
Group 2	.846
Group 3	.817
Group 4	.770

Table 4.15. Taxonomy of Retail Location Factors.

No.	Rotated Component Matrix(a)	No.	Rotated Component Matrix (a)
1	Service Facilities	1.10	Hospital
1.1	Post office	1.11	Minimart
1.2	Police station	1.12	Gas station/ Petrol stations
1.3	Fire station	1.13	Bank
1.4	Religious facilities (Temple, church, etc)	2	Transportation
1.5	Foundation	2.1	Proximity to shopping mall
1.6	Library	2.2	Short cut routes
1.7	Sport club, Gymnasium	2.3	No. of routes to shopping mall
1.8	Parks, Recreation Facilities	2.4	Bus stops
1.9	Governmental organizations	2.5	Mode of transportation

Table 4.15. Taxonomy of Retail Location Factors (Cont 1).

No.	Rotated Component Matrix (a)	No.	Rotated Component Matrix (a)
2.6	No. of bus lines	7.3	Location within shopping mall
2.7	Traffic	7.4	Product price change
2.8	No. of lanes	8	Economy
3	Culture	8.1	Household income and expenditure
3.1	Local language	8.2	GDP
3.2	Race/nationality	8.3	Import and export rate
3.3	Local culture	8.4	Purchasing behavior
3.4	Drug stores	8.5	No. businesses, closures, and existence
3.5	Immigration/ emigration rate	8.6	Sales trend in the area
4	Places with Prospective Shoppers	9	Competition
4.1	Entertainment complex	9.1	Nearby shopping mall
4.2	Concert exhibition halls	9.2	Competitors around shopping mall
4.3	Education institutions	9.3	Fresh market
4.4	Hotel	9.4	Restaurant /cafeteria
4.5	Airport	9.5	Community seat
4.6	Zoning	10	Environmental & Sanitary Issues
5	Volume & Variety	10.1	Air pollution
5.1	Product variety	10.2	Noise pollution
5.2	Population	10.3	Ventilation within shopping mall
5.3	Size of shopping mall	10.4	Flood
5.4	Design/decoration	10.5	Restrooms of shopping mall
5.5	Inflation rate	11	Utilities & Infrastructure
6	Governmental Concerns	11.1	Utilities
6.1	Government policies	11.2	Phone/Internet services
6.2	Regulatory matters	11.3	Water and sewage system
6.3	Property taxes, land taxes	11.4	Parking space within shopping mall
6.4	Structure of government	12	Labor
7	Shopping Centers Management	12.1	Labor supply
7.1	Management	12.2	Labor skills
7.2	Security around shopping mall	12.3	Labor quality

Table 4.15. Taxonomy of Retail Location Factors (Cont 1).

No.	Rotated Component Matrix (a)	No.	Rotated Component Matrix (a)
12.4	Labor attitude	16.2	Rental cost
12.5	Community attitude	16.3	Land cost
13	Politics and Beliefs	16.4	Investment capital
13.1	Fengshui	17	Media
13.2	Terrorism	17.1	Advertising media
13.3	War/ revolution	17.2	Fashion trend
13.4	Research/operations expenditure	17.3	Technology change
14	Business Convenience	18	Ownership & Expansion
14.1	Business services	18.1	Type of ownership (rent, own, lease)
14.2	Proximity to head office	18.2	Expansion space
14.3	Proximity to sources of materials	19	Other
15	Industrial Facilities	19.1	Types of road surface
15.1	Warehouse, godown	19.2	Massage parlor
15.2	Industrial area	19.3	Used products shops
16	Costs	20	Bank Rates
16.1	Construction/decoration costs	20.1	Currency exchange rate
		20.2	Interest rate

Note: Extraction method: principle component analysis. Rotation method: Varimax with Kaiser Normalization.

KMO measure of sampling adequacy = 0.88. Bartlett's test of sphericity: approx. chi-square = 23997.50, df = 4465, p = 0.000.

To this point, the 95 retail location factors from the original list had been placed into a total of 19 groups of 75 factors. Establishing the priorities for these 19 groups would facilitate the tackling of location problems in a timely manner, since prioritizing factor groups helps to determine which groups ought to be considered first. All factors must be minimized in each group before the use of structural equation modeling (SEM) to ratify the retail location factors. Linear regression estimates for the coefficients in the linear equation that involve one or more independent variables would best predict the value of the dependent variable, employed to evaluate the most positive effects on the factors that corresponded constructs to the retail location factors.

This research applied item parceling, which combined items into small groups of items within scales or subscales (Bandalos, 2002; Bandalos and Finney, 2001; Little et al. 2002; Nasser and Takahashi, 2003). Bandalos and Finney (2001) found that the three most common reasons researchers have cited in using item parceling are to increase the stability of the parameter estimates (29%), improve the variable to sample size ratio (22.6%), and remedy small sample sizes (21%). In many studies done to evaluate the effectiveness of item parceling to solve data problems, the solutions have been compared to disaggregated analyses without item parcels. Bagozzi and Heatherton (1994) reported that, in most cases, parceling was preferred to disaggregate analyses because there is a decrease in measurement errors with the parceled sets of items (Bagozzi and Heatherton, 1994; Bagozzi and Edwards, 1998).

Nasser and Takahashi (2003) demonstrated that parceled data that contained more items in each parcel would result in better normality, continuity, validity, and reliability than parceled data that contained fewer items. Distributing similar items across different parcels may help improve model fit (Kishton and Widaman, 1994; Lawrence and Dorans, 1987; Manhart, 1996; Schau, et al., 1995, Thompson and Melancon, 1996). In addition, MacCallum, et al. (1999) stated that parceled solutions provide a better-fit model because of the fewer parameters to estimate, the fewer chances for correlated residuals, and the reduction in sampling error. This was consistent with the study by MacCallum, et al. (1999), who provided similar reasons to use item parcels as indicators of latent factors: parceled data have fewer parameters to estimate, both locally in defining a construct and globally in representing the entire model, and are also less likely to produce correlated residuals or multiple cross-loadings, thus leading to reductions in sampling error. The research also correlated with that done by Little et al. (2002), who listed three reasons why parceling is more advantageous over using the original items as follows: 1) the estimation of large item numbers is likely to result in plausible but false correlations; 2) subsets of items from a large item pool will likely share specific variant sources that may not be of primary interest, and 3) parcel item solutions are more likely to yield stable solutions than item-level data.

The Nearby Service Facilities (group 1) is processed by item parceling in syntax output as follows:

```
compute subgroup1=mean(p3_8_16,p3_8_6,p3_8_4).
compute subgroup2=mean(p3_8_12,p3_8_19,p3_8_24).
compute subgroup3=mean(p3_8_26,p3_8_7,p3_8_5,p3_8_18).
frequencies variables =subgroup1 subgroup2 subgroup3.
```

The Economy (group 2) is processed by item parceling in syntax output as follows:

```
compute subgroup4=mean(p3_4_8,p3_9_1,p3_4_5).
compute subgroup5=mean(p3_9_6,p3_4_3,p3_4_4).
compute subgroup6=mean(p3_4_1,p3_4_2,p3_4_6,p3_6_3).
frequencies variables =subgroup4 subgroup5 subgroup6.
```

The Transportation (group 3) is processed by item parceling in syntax output as follows:

```
compute subgroup7=mean(p3_8_17,p3_1_1).
compute subgroup8=mean(p3_1_6,p3_1_3).
compute subgroup9=mean(p3_1_7,p3_1_2,p3_1_4).
frequencies variables =subgroup7 subgroup8 subgroup9.
```

The Government concerns (group 4) is processed by item parceling in syntax output as follows:

compute subgroup10=mean(p3_4_13,p3_7_2).

compute subgroup11=mean(p3_7_4,p3_7_1).

compute subgroup12=mean(p3_7_3).

frequencies variables =subgroup10 subgroup11 subgroup12.

Jöreskog and his colleagues (notably Dag Sörbom) created the structural equation modeling (SEM) as well as integrated data analysis traditions of factor analysis and multiple regression (Jöreskog, 1973). Kline (1998) recommended that researchers test the measurement model inherent in the full structural equation model first to find whether the fit of the measurement model is acceptable, before proceeding to the second step and testing the structural model through comparisons of its fit with different structural models. Therefore, the researcher utilized AMOS (Analysis of Moment Structures), a recent package that has become popular due to its friendly graphical interface and the ease with which users can specify structural models. At first, a model was constructed by considering the factor group with the highest eigenvalue before adding the other groups one by one. To illustrate the regression analysis results of the evaluated model from Figure 4.3-4.6, the data in Tables 4.20-4.21 were utilized.

More latency was added in the research test model's structural equation modeling until the goodness-of-fit test results were acceptable. Once accepted, the researcher then interprets the path coefficients in the model, since path coefficients in poor fit models are not meaningful. Numerous goodness-of-fit measures exist – LISREL (Linear Structural Relations) employs 15 while AMOS has 25.

Table 4.16. Item Parceling of Each Groups in Retail Location Factors.

Symbol of Each Factors	Cronbach's Alpha if Item Deleted	Subgroup	Retail Location Factors
Nearby Service Facilities			
P3_8_16	0.8701	1	Restaurants/cafeteria
P3_8_6	0.8663	1	Governmental organizations
P3_8_4	0.8548	1	Education institutions
P3_8_12	0.8658	2	Police station
P3_8_19	0.8603	2	Bank
P3_8_24	0.8601	2	Entertainment complex
P3_8_26	0.8649	3	Concert exhibition halls
P3_8_7	0.8648	3	Community seat
P3_8_5	0.8623	3	Parks, Recreation Facilities
P3_8_18	0.8617	3	Hospital
Economy			
P3_4_8	0.8503	4	Research/operations expenditure
P3_9_1	0.845	4	Purchasing behavior
P3_4_5	0.8168	4	Inflation rate
P3_9_6	0.836	5	Immigration/ emigration rate
P3_4_3	0.8247	5	No. businesses, closures, and existence
P3_4_4	0.8174	5	Import and export rate
P3_4_1	0.8346	6	Average monthly household income and expenditure of each family
P3_4_2	0.8322	6	GDP
P3_4_6	0.8322	6	Interest rate
P3_6_3	0.8289	6	Flood
Transportation			
P3_8_17	0.7866	7	Proximity to shopping mall
P3_1_1	0.7287	7	Traffic
P3_1_6	0.7103	8	Short cut routes
P3_1_3	0.7375	8	No. of bus lines
P3_1_7	0.704	9	No. of routes to shopping mall
P3_1_2	0.7149	9	Bus stops
P3_1_4	0.7232	9	Mode of transportation

Table 4.16. Item Parceling of Each Groups in Retail Location Factors. (Cont 1)

Symbol of Each Factors	Cronbach's Alpha if Item Deleted	Subgroup	Retail Location Factors
Government concerns			
P3_4_13	0.7924	10	Currency exchange rate
P3_7_2	0.6933		Structure of government
P3_7_4	0.7221	11	Property taxes, land taxes
P3_7_1	0.7048		Regulatory matters (investment promotion, other legal services)
P3_7_3	0.7181	12	Government policies

The choice of which method to use is of dispute among methodologists. Jaccard and Choi (1996), however, recommended the use of at least three fit tests while Kline (1998) recommended at least four (including the chi-square, NFI, GFI, CFI, NNFI, and SRMR). While there is disagreement on which indexes to utilize, researchers are advised not to report on all of them, which makes the researcher appear to be fishing. Goodness-of-fit statistics should be reported as follows (Byrne, 2001):

Chi-square difference statistic: The significance of the difference between two SEM models are measured. The chi-square difference is a standard test statistic that compares a modified, nested model with the original. If the chi-square shows no significant change between the unconstrained original and the nested, constrained modified model, the modification is accepted. It must be noted that chi-square is size sensitive, where a small size difference in large samples can be found to be significant while large size differences in small samples may test as being insignificant.

CMIN/DF: CMIN/DF is relative chi-square in AMOS. Relative chi-square, also known as normal chi-square, is a chi-square fit index that is divided by degrees of freedom, which makes it less dependent on sample size. Carmines and Mclver (1981) stated that relative chi-square should be in the 2:1 or 3:1 range for an acceptable model, whereas Kline (1998) felt that 3 or less was acceptable and other researchers believed that models with values as high as 5 could be considered to have an adequate fit. Still others insist that the relative chi-square should be 2 or less.

RMR: Root mean square residuals, also known as RMS residuals, RMSR, and RMR, is a test wherein the closer the RMR is to 0, the better the model fit is for the model being tested. The rule of thumb is stated to be 0.05 or less.

Goodness-of-fit Index or GFI (Jöreskog-Sörbom GFI): The goodness-of-fit index is the percent of observed covariances that is explained by the covariances within the model. What this means is that while R^2 in multiple regression deals with error variance, GFI deals with the errors in reproducing the variance-covariance matrix. The equation for GFI is that GFI = FML/FO, where FO is the fit function when all model parameters are zero. While GFI varies from 0 to 1, it can theoretically give meaningless negative values. As GFI is often high when compared to other fit models, .95 is usually suggested as the cutoff. By convention, a model should be accepted only if the GFI is equal to or greater than .90. It should also be noted that a large sample size pushes the GFI up.

Adjusted goodness-of-fit index, or AGFI: The AGFI is a variant of GFI and uses the mean square, instead of the total sum of squares, in the numerator and denominator of 1-GFI. Varying from 0 to 1, it theoretically can yield meaningless negative values. An AGFI $>$ 1.0 is associated with just-identified models as well as models with an almost perfect fit, whereas an AGFI $<$ 0 indicates models that have an extremely poor fit, or a model that is based on a small sample size – the AGFI should also be at least .90. Similar to the GFI, the AGFI tends downward when degrees of freedom are large relative to the sample size (except when the number of parameters is very large), with the value generally getting larger as the sample size increases. Accordingly, the AGFI may underestimate the fit for small sample sizes (Bollen, 1990).

The normed fit index, or NFI. Also known as the Bentler-Bonett normed fit index or DELTA1, the NFI was developed as an alternative to CFI that did not require making chi-square assumptions. Varying from 0 to 1 (with 1 being the perfect fit), the NFI reflects the proportion, which the model improves, fit, when compared to the null model (random variables). For instance, an NFI of .50 means that the researcher's model improves fit by 50% when compared to the null model. By convention, NFI values below .90 indicate a need to re-specify the model; however, some authors have also used the more liberal cutoff of .80. NFI may underestimate fit for small samples (Ullman , 2001).

RFI: The relative fit index, also known as RFI and RHO1, is not guaranteed to vary from 0 to 1. An RFI value that is higher than 0.95 indicates a good fit.

IFI: The incremental fit index, also known as IFI and DELTA2, should be equal to or greater than .90 in order for a model to be accepted. The IFI value can be greater than 1.0 in certain circumstances.

TLI: The non-normed fit index, also known TLI (this is the label in AMOS), NNFI, the Bentler-Bonett non-normed fit index, the Tucker-Lewis index, or RHO2, is similar to NFI but penalizes for model complexity. NNFI is not guaranteed to vary from 0 to 1 and is also a fit index that is less affected by sample size. An NNFI value close to 1 indicates a good fit, while NNFI values below .90 indicate a need to re-specify the model. However, some authors have used the more liberal cutoff of .80, since TLI generally runs lower than GFI.

The comparative fit index, or CFI: The CFI compares the existing model's fit with a null model (called the "independence model") that assumes latent variables are uncorrelated, comparing the model's predicted covariance matrix to the observed covariance matrix and compares the null model (covariance matrix of 0's) with the observed covariance matrix. This is done to assess the percent of lack of fit, which is accounted for by going from the null model to the researcher's SEM model. The CFI is also utilized to test modifier variables that create a heteroscedastic relation between an independent and a dependent variable where the relationship varies because of the modifier class. It must be noted that when the observed covariance matrix has entries approaching 0's, there will be no non-zero correlations to explain and the CFI loses relevance. CFI is similar in meaning to NFI but penalizes for sample size. The CFI varies from 0 to 1, with a CFI close to 1 indicating a very good fit. The CFI value should be equal to or greater than .90 for the model to be accepted – the value of .90 means that 90% of the data covariation can be reproduced by the given model. It is computed with the equation (1-max(chisq-df,0))/(max(chisq-df),(chisqn-dfn),0)), where chisq and chisqn are chi-square for the given and null models, and df and dfn are the corresponding degrees of freedom.

Root mean square error of approximation, or RMSEA. Also known as the RMS, RMSE, and discrepancy per degree of freedom, the RMSEA value of less than or equal to .05 means that there is good model fit. More recently, Hu and Bentler (1999) suggested that the RMSEA should be less than or equal to .06 in order for the model to be considered as having a good fit. Without any requirements for comparisons with a null model and thus not requiring the researcher to postulate a model with complete independence of latent variables, RMSEA is a popular fit measure. In addition, RMSEA has a known distribution that is related to non-central chi-square distribution, its confidence intervals are reported by some statistical packages, and it is one of the fit indexes less affected by sample size. RMSEA is computed with the equation ((chisq/((n-1)df))-(df/((n-1)df)))*.5, where chisq is the model chi-square, df is the degrees of freedom, and n is number of subjects. Because df is in the denominator position, the RMSEA seems to correct for model complexity; however, it should be remembered that degrees of freedom are an imperfect measure of model complexity anyway. Since RMSEA computes average lack of fit per degree of freedom, a near-zero lack of fit in both a complex and simple model would result in RMSEA to be near zero in both, while most methodologists would judge the simpler model to be better on grounds of parsimony. Model comparisons using RMSEA should therefore be interpreted according to the parsimony ratio, which corrects for model complexity according to the formula PR = df(model)/df(maximum possible df).

AIC: The Akaike Information Criterion or AIC is a goodness-of-fit measure that adjusts the model chi-square in order to penalize for model complexity. The AIC reflects discrepancies between the covariance matrices implied by the model and those that are observed. Unlike the model chi-square that is used for hierarchical or nested models, the AIC may be used to compare non-hierarchical models as well. It is possible to obtain AIC values 〈0; however, the AIC value that is close to zero is one that reflects a good fit. Between two AIC measures, the model with a better fit is the one with the lower value.

Modification index (MI): Called the Lagrange Multiplier (LM) test or index because of the MI being a univariate form of LM, MI is used to adjust models for a better fit. This, however, must be done carefully and with theoretical justification, as blindly using MI heightens the risk of having model adjustments that do not make any sense. MI improvements in fit are assessed through reductions in the chi-square value. In AMOS, the modification indexes are about adding arrows, with high MI values putting up the flag on missing arrows that can then be added to the model. The output in AMOS for the MI lists the parameters (the arrows to add or subtract), the estimated chi-square value for the path (labeled "M.I."), the chi-square probability (in which significant ones are candidates for change), and the parameter change, which is the estimated new path coefficient of the changed model and labeled "Par Change." Both the MI and the parameter change should be looked at in conjunction, as the researcher may wish to add an arrow where the parameter change is large in absolute size, even if the corresponding MI is not the largest one.

When two error term variables are correlated, the decrease in the chi-square is assessed by the MI in the cases of covariance modification indices. In AMOS, for example, if a model with a covariance MI of 10 and a par change of 0.7 is re-specified so the two error terms covary, the covariance would be 0.7 with a reduction of model chi-square by 10 (remember, lower means better fit). High MI error covariances may be caused by redundant content of two items, method bias (such as common social desirability for both items), or the omission of exogenous factors, as the indicators share a common cause that is not in the model.

For estimated regression weight MI, the value reflects the change in chi-square when the path between the two variables is restored by the addition of an arrow.

One method to consider includes adding paths from parameters with modification indices exceeding 100, while another common strategy is to add the parameter with the largest MI (even if the index is less than 100) and looking at the result through the chi-square fit index. Adding paths or allowing correlated error terms should be done only when it makes both theoretical and statistical sense to do so, since the more modifications are done to reflect the MI of the sample, the more chance that the adjusted model cannot be replicated for future samples. A researcher must therefore be careful that modifcations are done according to the theory basis and not just the size of the MI.

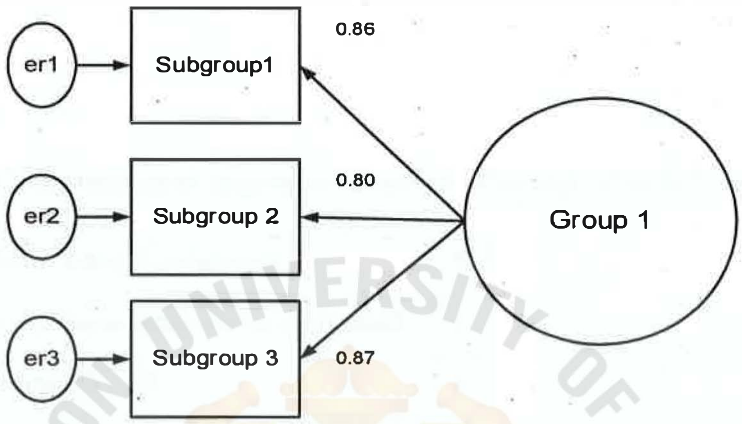

Figure 4.3. Result of the Analysis Model 1 (Standardized Estimates).

In the model shown in Figure 4.3, the observed endogenous variables can be classified into 3 subgroups with the highest contribution factors that affect retail location factors in the item parceling technique. The output from AMOS is displayed below:

Table 4.17. Parameter summary (Model 1).

Parameter	Weights	Covariances	Variances	Means	Intercepts	Total
Fixed	4	0	0	0	0	4
Labeled	0	0	0	0	0	0
Unlabeled	2	0	4	0	0	6
Total	6	0	4	0	0	10

As seen from Table 4.17, the parameter of unlabeled needs an estimate equal to 2 with 4 variance variables. Since the degree of freedom is 0, there is insufficient information to estimate the values, and the probability levels cannot be computed in this case. No covariances are shown in Table 4.17, since Figure 4.3 does not have any covariances.

Table 4.18. Computation of degrees of freedom of model 1(Default model).

Number of distinct sample moments:	6
Number of distinct parameters to be estimated:	6
Degrees of freedom (6 - 6):	0

Table 4.19. Regression Weights: (Model 1 - Default model).

Subgroup		Group	Estimate	S.E.	C.R.	P	Label
Subgroup1	<---	Group 1	1.00				
Subgroup2	<---	Group 1	.99	.05	18.75	***	par_1
Subgroup3	<---	Group 1	.97	.05	20.12	***	par_2

From Table 4.19 for the regression weight of model 1, the critical ratio (CR) is greather than 1.96 for the regression weight, with the estimated path parameter's significance being at .05.

Table 4.21 showcases the fit indices for model 1. Through the use of the SEM technqiue, initial tests with the structural model indicate there is a reasonable fit between the proposed structural model and the data, with the chi-square calculated to be 0 (P=0.000) with 0 degrees of freedom.

Table 4.20. Standardized Regression Weights: (Group number 1 - Default model).

Subgroup		Group	Estimate
Subgroup1	<---	Group 1	.86
Subgroup2	<---	Group 1	.80
Subgroup3	<---	Group 1	.87

Table 4.21. Model Fit Summary for Model 1.

Fit Indices	Value
χ^2	0
DF	0
P	0.000
χ^2/DF	0
GFI	1
NFI	1
RFI	-
IFI	1
TLI	-
CFI	1
RMSEA	0.74

The results are different from the data set with high significance level, as the sample size is sufficiently large enough to solve the model. As the rule of thumb states, the GFI should be greater than 0.90 in order for the model to be accepted. The GFI value for this model is 1, meaning a perfect goodness-of-fit index and indicating that the model does not have any covariance.

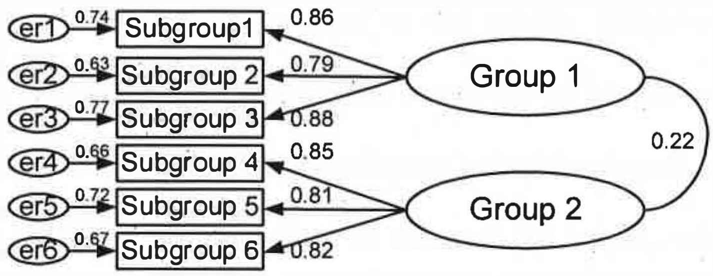

Figure 4.4. Result of the Analysis Model 2 (Standardized Estimates).

Table 4.22. Parameter summary (Model 2).

Parameter	Weights	Covariances	Variances	Means	Intercepts	Total
Fixed	8	0	0	0	0	8
Labeled	0	0	0	0	0	0
Unlabeled	4	1	8	0	0	13
Total	12	1	8	0	0	21

Model 2 has more variables than model 1, with an increase in the subgroups with the addition of subgroup 4, 5, and 6 as shown in Figure 4.4. Because group 2 has the second highest contribution to factor analysis, group 2 was added in order to test the model fit until it was insufficient.

Table 4.23. Computation of degrees of freedom of model 2 (Default model).

Number of distinct sample moments:	21
Number of distinct parameters to be estimated:	13
Degrees of freedom (21 - 13):	8

Figure 4.4 and Table 4.22 consisted of the weight, variances and covariance values. Whether the model can be computed or not can be clearly seen by looking at Table 4.23, where it is displayed that parameter calculations give sufficient enough information in order for the researcher to estimate the values, with the degree of freedom equaling 8. The probability level, therefore, can be computed in this case.

Table 4.24 showcases the regression weights of model 2. The critical ratio (CR) is greather than 1.96 for the regression weight, with the estimated path parameter's significance being at .05. The significance of estimated covariances among the latent variables are evaluated in a similar manner: if their CR is greater than 1.96, they are significant.

Table 4.24. Regression Weights: (Model 2 - Default model).

Subgroup		Group	Estimate	S.E.	C.R.	P	Label
Subgroup1	<---	Group 1	1.00				
Subgroup2	<---	Group 1	.98	.05	18.63	***	par_2
Subgroup3	<---	Group 1	.98	.05	20.30	***	par_3
Subgroup4	<---	Group 2	1.29	.07	17.69	***	par_4
Subgroup5	<---	Group 2	1.00				
Subgroup6	<---	Group 2	1.06	.06	17.34	***	par_5

Table 4.25 shows the estimated values of the standardized regression weights, which demonstrate how each subgroup can make its group more effective. For example, by increasing subgroup 1, group 1 would also be increased by 0.86. All values are shown in Figure 4.4

Table 4.25. Standardized Regression Weights: (Model 2 - Default model).

Subgroup		Group	Estimate
Subgroup1	<---	Group 1	.86
Subgroup2	<---	Group 1	.79
Subgroup3	<---	Group 1	.88
Subgroup4	<---	Group 2	.85
Subgroup5	<---	Group 2	.81
Subgroup6	<---	Group 2	.82

Table 4.26. Covariances: (Model 2 - Default model).

Group		Group	Estimate	S.E.	C.R.	P	Label
Group 2	<-->	Group 1	.09	.02	3.85	***	par_1

Table 4.27. Correlations: (Model 2 - Default model).

Group		Group	Estimate
Group 2	<-->	Group 1	.22

Because the critical ratio (CR) is greather than 1.96, with the significance at the .05 level, it can be seen that the correlation between groups 1 and 2 equals 0.22. This is shown in Table 4.27.

Table 4.29 displays the explained variance in each subgroup. Unexplained variance can be calculated through subtracting the explained variance in each group by one. What this means is that in Model 2, for example, sugroup 1 cannot explain 0.26 or 26% of the variance that is caused by effects from other factors.

Table 4.28. Variances: (Model 2 - Default model).

Parameter	Estimate	S.E.	C.R.	P	Label
Group 2	.31	.03	9.43	***	par_6
Group 1	.52	.05	10.40	***	par_7
er1	.18	.02	8.48	***	par_8
er2	.29	.03	11.09	***	par_9
er3	.15	.02	7.56	***	par_10
er4	.16	.02	9.82	***	par_11
er5	.20	.02	8.18	***	par_12
er6	.17	.02	9.52	***	par_13

Table 4.29. Squared Multiple Correlations: (Model 2 - Default model).

Subgroup	Estimate
Subgroup6	.67
Subgroup5	.72
Subgroup4	.66
Subgroup3	.77
Subgroup2	.63
Subgroup1	.74

Table 4.30. Covariances: (Model 2 - Default model).

Parameter			M.I.	Par Change
er4	<-->	Group 1	15.73	.07
er2	<-->	Group 2	27.42	-.09
er2	<-->	er5	11.40	-.05

Table 4.31. Regression Weights: (Model 2 - Default model).

Parameter			M.I.	Par Change
Subgroup 6	<---	Subgroup 2	13.82	-.10
Subgroup 4	<---	Group 1	14.81	.13
Subgroup 4	<---	Subgroup 3	16.35	.11
Subgroup 4	<---	Subgroup 2	17.65	.11
Subgroup 2	<---	Group 2	25.78	-.29
Subgroup 2	<---	Subgroup 6	27.72	-.21
Subgroup 2	<---	Subgroup 5	29.86	-.19

Table 4.30 showcases modification indices, which show how much the value of the chi-square value can be improved. For example, if the covariance between er4 and group1 are linked, the chi-square value will improve by a value of 15.73. Similarly in Table 4.31, the regression weight values can be improved by adding correlation between the latents. However, before any sort of modification or correlation addition is done, there should be substantial theoretical support.

Using the SEM technique, initial testing of the structural model indicates that there is reasonable fit between the data and the proposed structural model, with the chi-square value calculated as 63.78 (P=0.000) with 8 degrees of freedom. Table 4.32 presents selected goodness-of-fit statistics. It can be seen that GFI is greater than 0.90, which demonstrates the percent of the observed variances explained by the model's implied covariance. NFI is also calculated, and the model is not re-specified (Ullman, 2001). The IFI value of the model shows that it can be increased up to 0.96, while the TLI – being one of the goodness-of-fit indices that is less affected by sample size – is calculated to be 0.92 for the model. The CFI value of 0.96 also shows that there is a good fit for the model.

Table 4.32. Model Fit Summary for Model 2.

Fit Indices	Value
χ^2	63.78
DF	8
P	0.000
χ^2/DF	7.97
GFI	0.95
NFI	0.95
IFI	0.96
TLI	0.92
CFI	0.96
RMSEA	0.13

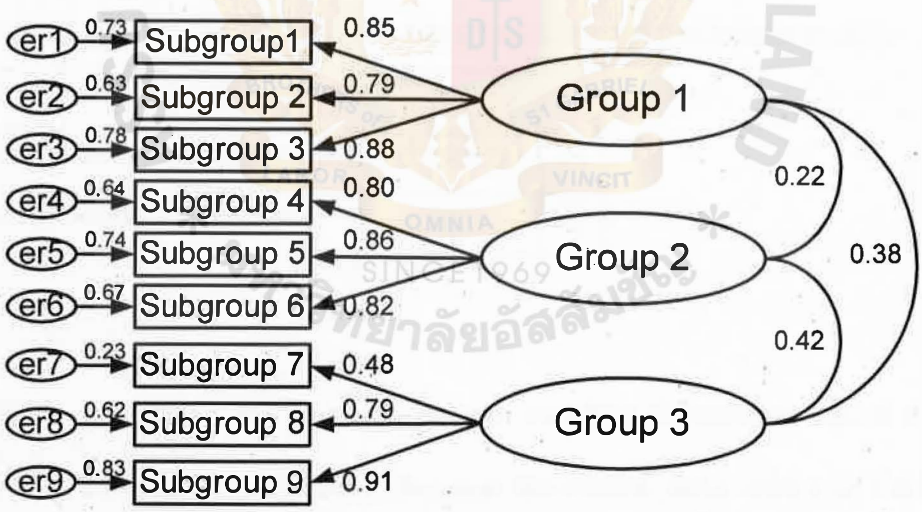

Figure 4.5. Result of the Analysis Model 3 (Standardized Estimates).

Model 3 showcases more variables than model 2, with subgroups 7, 8, and 9 being added into it as shown in Figure 4.5. Group 3 is higher than any other contribution from factor analysis, so group 3 was added to test the model for its fit until the fit was insufficient.

Table 4.33. Parameter summary (Model 3).

Parameter	Weights	Covariances	Variances	Means	Intercepts	Total
Fixed	12	0	0	0	0	12
Labeled	0	0	0	0	0	0
Unlabeled	6	3	12	0	0	21
Total	18	3	12	0	0	33

Table 4.34. Computation of degrees of freedom of model 3 (Default model).

Number of distinct sample moments:	45
Number of distinct parameters to be estimated:	21
Degrees of freedom (45 - 21):	24

Table 4.34 shows that there are enough variables to calculate values within this model, with 24 degrees of freedom. Because the critical value shown in Table 4.35 is greater than 1.96, all the subgroups are significantly different at a 99 percent confidence level. After the results confirmed that the regression value was significant, Table 4.36 was used to write the standardized regression weights found in Figure 4.5.

Table 4.35. Regression Weights: (Model 3 - Default model).

Subgroup		Group	Estimate	S.E.	C.R.	P	Label
Subgroup1	<---	Group 1	1.00				
Subgroup 2	<---	Group 1	.98	.05	18.55	***	par_4
Subgroup 3	<---	Group 1	.99	.05	20.49	***	par_5
Subgroup 5	<---	Group 2	1.26	.07	17.83	***	par_6
Subgroup 4	<---	Group 2	1.00				
Subgroup 6	<---	Group 2	1.06	.06	17.65	***	par_7
Subgroup 8	<---	Group 3	1.76	.19	9.49	***	par_8
Subgroup 7	<---	Group 3	1.00				
Subgroup 9	<---	Group 3	1.86	.20	9.31	***	par_9

Table 4.36. Standardized Regression Weights: (Model 3 - Default model).

Subgroup		Group	Estimate
Subgroup 1	<---	Group 1	.85
Subgroup 2	<---	Group 1	.79
Subgroup 3	<---	Group 1	.89
Subgroup 5	<---	Group 2	.84
Subgroup 4	<---	Group 2	.82
Subgroup 6	<---	Group 2	.83
Subgroup 8	<---	Group 3	.79
Subgroup 7	<---	Group 3	.48
Subgroup 9	<---	Group 3	.91

Table 4.37. Covariances: (Model 3 - Default model).

Parameter			Estimate	S.E.	C.R.	P	Label
Group 2	<-->	Group 1	.09	.02	3.89	***	par_1
Group 1	<-->	Group 3	.09	.02	5.41	***	par_2
Group 2	<-->	Group 3	.08	.01	5.69	***	par_3

Table 4.38. Correlations: (Model 3 - Default model).

Parameter			Estimate
Group 2	<-->	Group 1	.22
Group 1	<-->	Group 3	.38
Group 2	<-->	Group 3	.42

Table 4.39. Variances: (Model 3 - Default model).

Parameter	Estimate	S.E.	C.R.	P	Label
Group 2	.31	.03	9.56	***	par_10
Group 1	.51	.05	10.31	***	par_11
Group 3	.11	.02	4.87	***	par_12
er1	.19	.02	8.93	***	par_13
er2	.29	.03	11.21	***	par_14
er3	.14	.02	7.25	***	par_15
er4	.16	.02	9.73	***	par_16

Table 4.40 displays the explained variance in each subgroup. Unexplained variance can be calculated through subtracting the explained variance in each group by one. What this means is that in Model 3, subgroup 1 cannot explain 0.27 or 27% of the

variance that is caused by effects from other factors, which is the same pattern as previously mentioned.

Table 4.39. Variances: (Model 3 - Default model) (Cont.1).

Parameter	Estimate	S.E.	C.R.	P	Label
er5	.21	.02	8.92	***	par_17
er6	.16	.02	9.42	***	par_18
er7	.37	.03	13.78	***	par_19
er8	.21	.02	8.53	***	par_20
er9	.08	.02	3.32	***	par_21

Table 4.40. Squared Multiple Correlations: (Model 3 - Default model).

Subgroup	Estimate
Subgroup 9	.83
Subgroup 8	.62
Subgroup 7	.23
Subgroup 6	.68
Subgroup 5	.70
Subgroup 4	.67
Subgroup 3	.78
Subgroup 2	.63
Subgroup 1	.73

Table 4.41 showcases modification indices, which show how much the value of the chi-square value can be improved. For example, if the covariance between er7 and group1 are linked, the chi-square value will improve by a value of 28.59. Similarly in

Table 4.42, the regression weight values can be improved by adding correlation between the latents. However, before any sort of modification or correlation addition is done, there should be substantial theoretical support.

Table 4.41. Covariances: (Model 3 - Default model).

Parameter			M.I.	Par Change
er7	<-->	Group 3	11.00	-.03
er7	<-->	Group 1	28.59	.11
er7	<-->	Group 2	11.82	.06
er7	<-->	er8	14.69	-.06
er6	<-->	Group1	12.29	-.06
er4	<-->	Group 1	11.93	.05
er2	<-->	Group 2	21.82	-.08
erl	<-->	er7	20.06	.07

Table 4.44 summarizes the model fit through the use of the SEM technique. Initial testing of the structural model indicates that there is reasonable fit between the data and the proposed structural model, with the chi-square value calculated as 158.71 (P=0.000) with 24 degrees of freedom and thus indicating normal data distribution.

The GFI value of model 3 is only 0.03 lower than model 2, so it is still acceptable at 0.92. NFI is also accepted at its value of 0.92, greater than 0.80 suggested by Ullman (2001), and can be an incremental fit index up to 0.93. The Tucker-Lewis index value was 0.89, acceptable due to the cutoff level being 0.80. In addition, the CFI provides 93.0% evidence of a good fitting model; however, the initial model RMSEA of 0.12 is not really within the recommended acceptability range of 0.05-0.08.

Table 4.42. Regression Weights: (Model 3 - Default model).

Parameter			M.I.	Par Change
Subgroup 9	<---	Subgroup 5	10.27	-.08
Subgroup 8	<---	Subgroup 7	11.00	-.12
Subgroup 7	<---	Group 1	26.07	.23
Subgroup 7	<---	Group 2	11.66	.20
Subgroup 7	<---	Subgroup 4	12.69	.16
Subgroup 7	<---	Subgroup 3	16.37	.15
Subgroup 7	<---	Subgroup 2	15.06	.13
Subgroup 7	<---	Subgroup 1	36.94	.22
Subgroup 6	<---	Subgroup 2	14.88	-.10
Subgroup 4	<---	Group 1	15.34	.13
Subgroup 4	<---	Subgroup 3	15.73	.11
Subgroup 4	<---	Subgroup 2	17.98	.11
Subgroup 2	<---	Group 2	25.29	-.28
Subgroup 2	<---	Subgroup 6	27.74	-.21
Subgroup 2	<---	Subgroup 5	28.59	-.18
Subgroup 1	<---	Subgroup 7	12.58	.13

Table 4.43. Model Fit Summary for Model 3.

Fit Indices	Value
χ^2	158.71
DF	24
P	0.000
χ^2/DF	6.61
GFI	0.92
NFI	0.92

Table 4.43. Model Fit Summary for Model 3(Cont.1).

Fit Indices	Value
IFI	0.93
TLI	0.89
CFI	0.93
RMSEA	0.12

Model 4, the last model, had more variables than model 3 with additional subgroups 10, 11, and 12. There were also subgroups with factors of governmental concern (group4). The structure is displayed in Figure 4.6.

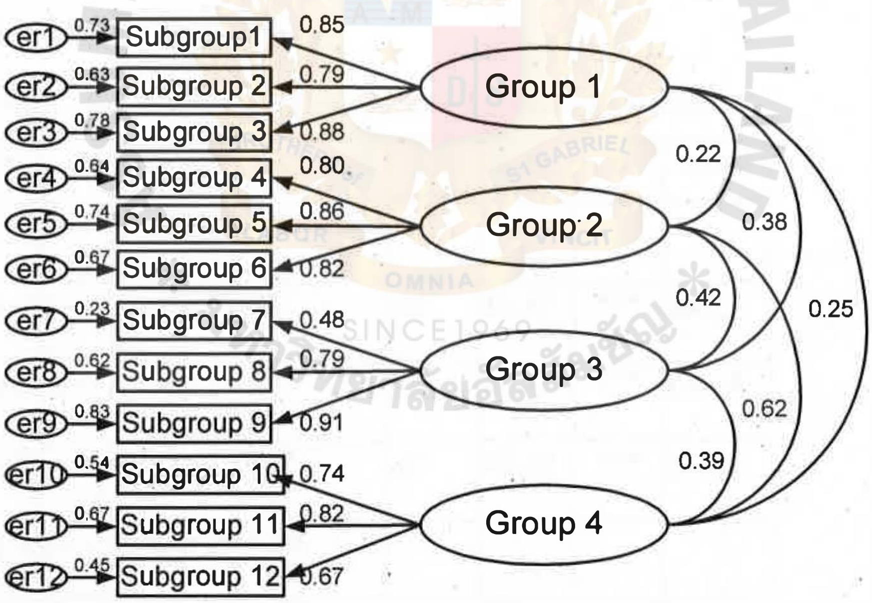

Figure 4.6. Result of the Analysis Model 4 (Standardized Estimates).

Table 4.44 has more covariance and weight variables to solve the problem when adding subgroups, based on 48 degrees of freedom shown in Table 4.45.

Table 4.44. Parameter Summary (Model 4).

Parameter	Weights	Covariances	Variances	Means	Intercepts	Total
Fixed	16	0	0	0	0	16
Labeled	0	0	0	0	0	0
Unlabeled	8	6	16	0	0	30
Total	24	6	16	0	0	46

Table 4.45. Computation of Degrees of Freedom of Model 4 (Default model).

Number of distinct sample moments:	78
Number of distinct parameters to be estimated:	30
Degrees of freedom (78 - 30):	48

Table 4.46. Regression Weights: (Model 4 - Default model).

Subgroup		Group	Estimate	S.E.	C.R.	P	Label
Subgroup 1	<---	Group 1	1.00				
Subgroup 2	<---	Group 1	.98	.05	18.59	***	par_7
Subgroup 3	<---	Group 1	.99	.05	20.52	***	par_8
Subgroup 5	<---	Group 2	1.32	.07	18.19	***	par_9
Subgroup 4	<---	Group 2	1.00				

The critical values demonstrated in Table 4.46 are different in a highly significant way. After confirming the significance of the regression values, Table 4.47 was used to write the standardized regression weights for Figure 4.6. The covariance critical value in 4.48 was also different in a highly significant way, at a confidence level of 99 percent.

Table 4.46. Regression Weights: (Model 4 - Default model)(Cont.1).

Subgroup		Group	Estimate	S.E.	C.R.	P	Label
Subgroup 6	<---	Group 2	1.08	.06	17.56	***	par_10
Subgroup 8	<---	Group 3	1.76	.19	9.50	***	par_11
Subgroup 7	<---	Group 3	1.00				
Subgroup 9	<---	Group 3	1.85	.20	9.36	***	par_12
Subgroup 11	<---	Group 4	.99	.07	13.63	***	par_13
Subgroup 10	<---	Group 4	1.00				
Subgroup 12	<---	Group 4	1.12	.09	12.16	***	par_14

Table 4.47. Standardized Regression Weights: (Model 4 - Default model).

Parameter			Estimate
Subgroup 1	<---	Group 1	.85
Subgroup 2	<---	Group 1	.79
Subgroup 3	<---	Group 1	.88
Subgroup 5	<---	Group 2	.86
Subgroup 4	<---	Group 2	.80
Subgroup 6	<---	Group 2	.82

Table 4.47. Standardized Regression Weights: (Model 4 - Default model)(Cont.1).

Parameter			Estimate
Subgroup 8	<---	Group 3	.79
Subgroup 7	<---	Group 3	.48
Subgroup 9	<---	Group 3	.91
Subgroup 11	<---	Group 4	.82
Subgroup 10	<---	Group 4	.74
Subgroup 12	<---	Group 4	.67

Table 4.48. Covariances: (Model 4 - Default model).

Pasameter			Estimate	S.E.	C.R.	P	Label
Group 2	<-->	Group 1	.09	.02	3.82	***	par_1
Group 1	<-->	Group 2	.09	.02	5.42	***	par_2
Group 1	<-->	Group 4	.11	.03	4.13	***	par_3
Group 2	<-->	Group 3	.08	.01	5.64	***	par_4
Group 2	<-->	Group 4	.21	.03	8.24	***	par_5
Group 3	<-->	Group 4	.08	.02	5.23	***	par_6

The correlation values of each latent shown in Table 4.49 can be written for Figure 4.6, with the highest correlation between groups 2 and 4.

Table 4.49. Correlations: (Model 4 - Default model).

Parameter			Estimate
Group 2	<-->	Group 1	.22
Group 1	<-->	Group 3	.38
Group 1	<-->	Group 4	.25
Group 2	<-->	Group 3	.42
Group 2	<-->	Group 4	.62
Group 3	<-->	Group 4	.39

Table 4.50. Variances: (Model 4 - Default model).

Parameter	Estimate	S.E.	C.R.	P	Label
Group 2	.30	.03	9.36	***	par_15
Group 1	.51	.05	10.33	***	par_16
Group 3	.11	.02	4.87	***	par_17
Group 4	.39	.05	7.90	***	par_18
er1	.19	.02	8.90	***	par_19
er2	.29	.03	11.20	***	par_20
er3	.14	.02	7.34	***	par_21
er4	.17	.02	10.60	***	par_22
er5	.19	.02	8.42	***	par_23
er6	.17	.02	9.96	***	par_24
er7	.37	.03	13.78	***	par_25
er8	.21	.02	8.57	***	par_26
er9	.08	.02	3.51	***	par_27
er10	.33	.03	10.37	***	par_28
er11	.19	.02	7.67	***	par_29
er12	.60	.05	11.73	***	par_30

Table 4.51. Squared Multiple Correlations: (Model 4 - Default model).

Subgroup	Estimate
Subgroup 12	.45
Subgroup 11	.67
Subgroup 10	.54
Subgroup 9	.83
Subgroup 8	.62
Subgroup 7	.23
Subgroup 6	.67
Subgroup 5	.74
Subgroup 4	.64
Subgroup 3	.78
Subgroup 2	.63
Subgroup 1	.73

Table 4.51 displays the explained variance in each subgroup. Unexplained variance can be calculated through subtracting the explained variance in each group by one. What this means is that in Model 4, sugroup 1 cannot explain 0.27 or 27% of the variance that is caused by effects from other factors. This pattern is the same one that has been previously mentioned.

Table 4.52 showcases modification indices, which show how much the value of the chi-square value can be improved. For example, if the covariance between er7 and group1 are linked, the chi-square value will improve by a value of 28.03. Similarly in Table 4.53, the regression weight values can be improved by adding correlation between the latents. However, before any sort of modification or correlation addition is done, there should be substantial theoretical support.

Table 4.52. Covariances: (Model 4 - Default model).

Parameter			M.I.	Par Change
er12	<-->	Group 1	13.53	.11
er7	<-->	Group 3	11.25	-.03
er7	<-->	Group 1	28.03	.11
er7	<-->	er8	15.45	-.06
er6	<-->	Group 1	10.48	-.05
er5	<-->	Group 3	12.67	-.03
er5	<-->	er10	17.11	.07
er5	<-->	er9	11.13	-.04
er4	<-->	Group 1	12.66	.06
er3	<-->	er12	19.23	.09
er2	<-->	Group 2	20.74	-.06
erl	<-->	er12	10.49	-.07
erl	<-->	er7	19.85	.07

Table 4.53. Regression Weights: (Model 4 - Default model).

Parameter			M.I.	Par Change
Subgroup 12	<---	Group 1	10.75	.20
Subgroup 12	<---	Subgroup 3	18.75	.22
Subgroup 12	<---	Subgroup 2	10.54	.15
Subgroup 10	<---	Subgroup 5	12.31	.13
Subgroup 9	<---	Subgroup 5	10.59	-.08
Subgroup 8	<---	Subgroup 7	11.56	-.12
Subgroup 7	<---	Group 1	26.05	.23
Subgroup 7	<---	Group 2	11.70	.20
Subgroup 7	<---	Subgroup 11	10.82	.13
Subgroup 7	<---	Subgroup 4	12.82	.16

Table 4.53. Regression Weights: (Model 4 - Default model). (Cont.1)

Parameter			M.I.	Par Change
Subgroup 7	<---	Subgroup 3	16.29	.15
Subgroup 7	<---	Subgroup 2	14.98	.13
Subgroup 7	<---	Subgroup 1	36.72	.22
Subgroup 6	<---	Subgroup 2	12.82	-.09
Subgroup 5	<---	Subgroup 10	12.97	.11
Subgroup 5	<---	Subgroup 9	11.29	-.13
Subgroup 4	<---	Group 1	15.22	.13
Subgroup 4	<---	Subgroup 3	16.21	.11
Subgroup 4	<---	Subgroup 2	17.06	.11
Subgroup 3	<---	Subgroup 12	12.34	.08
Subgroup 2	<---	Group 2	25.54	-.29
Subgroup 2	<---	Subgroup 10	11.03	-.11
Subgroup 2	<---	Subgroup 6	27.69	-.21
Subgroup 2	<---	Subgroup 5	28.89	-.19
Subgroup 1	<---	Subgroup 7	12.47	.13

Table 4.54. Model Fit Summary for Model 4.

Fit Indices	Value
χ^2	274.15
DF	48
P	0.000
χ^2/DF	5.71
GFI	0.91
NFI	0.89

Table 4.54. Model Fit Summary for Model 4. (Cont.1)

Fit Indices	Value
IFI	0.91
TLI	0.88
CFI	0.91
RMSEA	0.10

After the addition of a new factor group, the comparative fit index (CFI) was computed in Table 4.54. If the CFI was discovered to be less than 90 percent, the added group would be eliminated and the process stopped; otherwise, the process would continue with the addition of the next group with a lower eigenvalue. Since results showed that up to four factor groups were included, the CFI was therefore still greater than 90 percent. In a baseline comparison, the comparitive fit index for the four groups equaled 91 percent while the chi-square had a value of 274.15 with 48 degrees of freedom, a value that was different in a significant way at a confidence level of 99 percent.

Figure 4.6 showed the grouping results, which were described as follows:

Group 1: Nearby Service Facilities, with 3 subgroups. Subgroup 1 was composed of restaurants/ cafeteria, governmental organizations, and educational institutions; subgroup 2 comprised police stations, banks, and entertainment complexes; subgroup 3 included community seats, parks, and hospitals. The squared multiple correlations for each subgroup could be explained as follows: 73%, 63%, and 78% of the variances of subgroups 1, 2, and 3 are accounted for by the variance in Group1, respectively, while the remaining 27%, 37%, and 22% of the variances of subgroups 1, 2, and 3 cannot be explained by this model and thus attributed to unique factor er1, er2, and er3, respectively. The standardized regression weights of subgroups 1, 2, and 3 are 85%, 79%, and 88%, respectively, with the critical ratios of all subgroups being much greater than 1.96. This is an indication of a difference that is significant at a 0.001 level of confidence.

Group 2: Economy, with three subgroups. Subgroup 4 consisted of research/ operations expenditure, consumers' purchasing behavior, and inflation rates; subgroup 5 included immigration/ emigration rates, number of business closures and existences, and import and export rates; and subgroup 6 consisted of the average monthly household income and expenditure, GDP, interest rates, and floods.

Group 3: Transportation, with three subgroups. Subgroup 7 included proximity to the shopping centers and traffic conditions; subgroup 8 consisted of short-cut routes and the number of bus lines; while subgroup 9 comprised the available routes to the shopping centers, the bus stops, and the modes of transportation.

Group 4: Governmental Concerns, with three subgroups. Subgroup 10 included currency exchange rates and government structure; subgroup 11 comprised property taxes and regulatory matters; and subgroup 12 consisted of government policies.

4.4 Managing Retail Location Factors Network Data

In this section, author will derive the detail of each observed variables in the subgroup level, which correspond in the Figure 3.2.

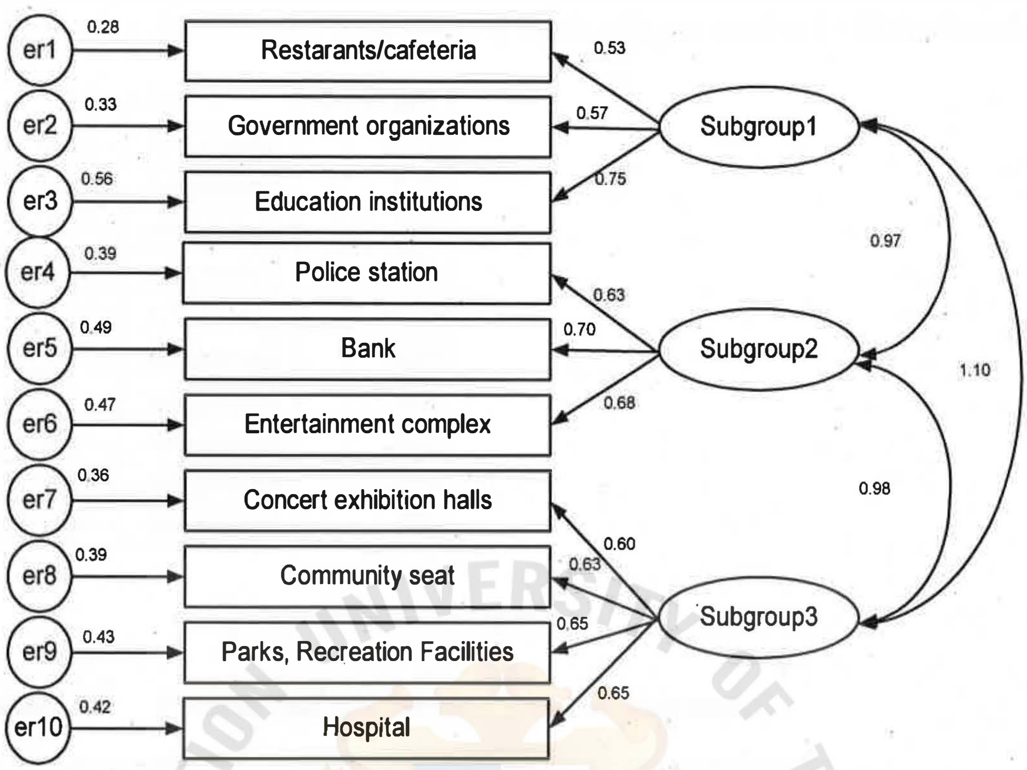

Figure 4.7. Result of the Observed variables within Subgroup 1, 2, 3 (Standardized Estimates).

Table 4.55. Regression Weights: (Model 4 - Default model).

Parmeter			Estimate	S.E.	C.R.	P	Label
P3_8_6	<---	subgroup1	.937	.102	9.165	***	par_1
P3_8_16	<---	subgroup1	1.000				
P3_8_4	<---	subgroup1	1.440	.134	10.715	***	par_2
P3_8_19	<---	subgroup2	1.101	.097	11.316	***	par_3
P3_8_12	<---	subgroup2	1.000				
P3_8_24	<---	subgroup2	1.089	.097	11.173	***	par_4
P3_8_7	<---	subgroup3	.867	.080	10.790	***	par_5
P3_8_26	<---	subgroup3	1.000				
P3_8_5	<---	subgroup3	1.020	.092	11.145	***	par_6
P3_8_18	<---	subgroup3	.924	.084	11.040	***	par_7

Table 4.56. Standardized Regression Weights: (Group number 1 - Default model).

Parameter			Estimate
P3_8_6	<---	subgroup1	.572
P3_8_16	<---	subgroup1	.525
P3_8_4	<---	subgroup1	.747
P3_8_19	<---	subgroup2	.696
P3_8_12	<---	subgroup2	.626
P3_8_24	<---	subgroup2	.684
P3_8_7	<---	subgroup3	.626
P3_8_26	<---	subgroup3	.602
P3_8_5	<---	subgroup3	.654
P3_8_18	<---	subgroup3	.646

Table 4.57. Covariances: (Group number 1 - Default model).

Parameter			Estimate	S.E.	C.R.	P	Label
subgroup1	<-->	subgroup2	.407	.052	7.780	***	par_8
subgroup2	<-->	subgroup3	.486	.058	8.389	***	par_9
subgroup1	<-->	subgroup3	.473	.059	8.050	***	par_10

Table 4.58. Correlations: (Group number 1 - Default model).

Parameter			Estimate
subgroup1	<-->	subgroup2	.969
subgroup2	<-->	subgroup3	.978
subgroup1	<-->	subgroup3	1.103

Table 4.59. Squared Multiple Correlations: (Group number 1 - Default model).

Parameter	Estimate
P3_8_18	.417
P3_8_5	.428
P3_8_7	.392
P3_8_26	.362
P3_8_24	.468
P3_8_19	.485

Table 4.59. Squared Multiple Correlations: (Group number 1 - Default model). (Cont.1)

Parameter	Estimate
P3_8_12	.392
P3_8_4	.557
P3_8_6	.327
P3_8_16	.276

The critical values demonstrated in Table 4.55 are different in a highly significant way. After confirming the significance of the regression values, Table 4.56 was used to write the standardized regression weights for Figure 4.7. The covariance critical value in Table 4.57 was also different in a highly significant way, at a confidence level of 99 percent. The equation of subgroup 1, 2, 3 express their relationship as shown in Figure 4.7 as follows:

$$F_{\text{Subgroup1}} = 0.53\ f_{\text{Restarants}} + 0.57\ f_{\text{Government organizations}} + 0.88\ f_{\text{Education}} \quad (1)$$

$$F_{\text{Subgroup2}} = 0.63\ f_{\text{Police station}} + 0.70\ f_{\text{Bank}} + 0.68\ f_{\text{Entertainment complex}} \quad (2)$$

$$F_{\text{Subgroup3}} = 0.60\ f_{\text{Concert hall}} + 0.63\ f_{\text{Community seat}} + 0.65\ f_{\text{Parks}} + 0.65\ f_{\text{Hospital}} \quad (3)$$

The critical values demonstrated in Table 4.60 are different in a highly significant way. After confirming the significance of the regression values, Table 4.61 was used to write the standardized regression weights for Figure 4.8. The covariance critical value in Table 4.62 was also different in a highly significant way, at a confidence level of 99 percent. The equation of subgroup 4, 5, 6 express their relationship as shown in Figure 4.8 as follows:

$$F_{\text{Subgroup4}} = 0.36\ f_{\text{Research expenditure}} + 0.39\ f_{\text{Purchasing behavior}} + 0.70\ f_{\text{Inflation rate}} \quad (4)$$

$$F_{Subgroup5} = 0.54\ f_{Immigration\ rate} + 0.70\ f_{No.\ business} + 0.76\ f_{Import\ and\ export\ rate} \quad (5)$$

$$F_{Subgroup6} = 0.55\ f_{Household\ income\ and\ expenditure} + 0.59\ f_{GDP} + 0.61\ f_{Interest\ rate} + 0.68\ f_{Flood} \quad (6)$$

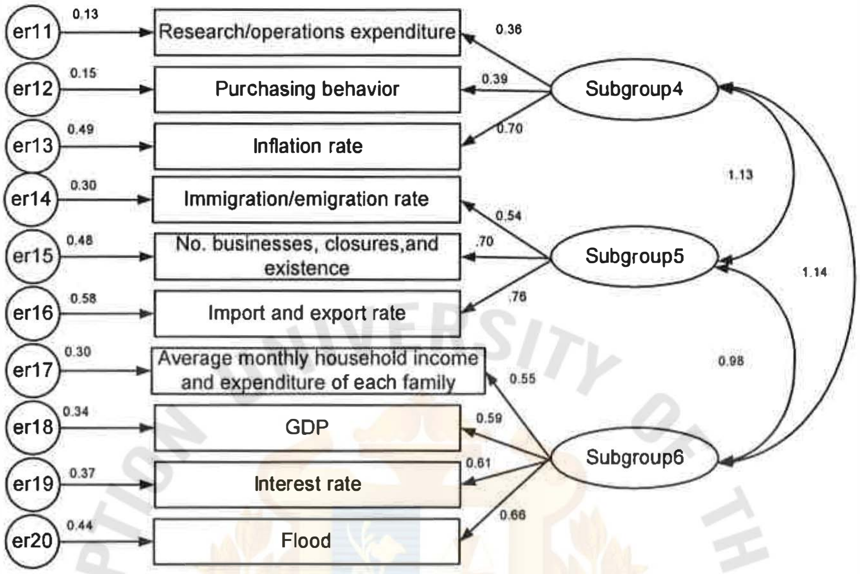

Figure 4.8. Result of the Observed variables within Subgroup 4, 5, 6 (Standardized Estimates).

Table 4.60. Regression Weights: (Group number 1 - Default model).

Parameter			Estimate	S.E.	C.R.	P	Label
P3_9_1	<---	subgroup4	.822	.135	6.092	***	par_1
P3_4_8	<---	subgroup4	1.000				
P3_4_5	<---	subgroup4	1.879	.243	7.718	***	par_2
P3_9_6	<---	subgroup5	1.000				
P3_4_4	<---	subgroup5	1.373	.129	10.662	***	par_3
P3_4_3	<---	subgroup5	1.147	.113	10.165	***	par_4
P3_4_1	<---	subgroup6	1.000				
P3_4_2	<---	subgroup6	1.155	.125	9.266	***	par_5
P3_4_6	<---	subgroup6	1.341	.141	9.523	***	par_6
P3_6_3	<---	subgroup6	2.004	.200	10.040	***	par_7

Table 4.61. Standardized Regression Weights: (Group number 1 - Default model).

Parameter			Estimate
P3_9_1	<---	subgroup4	.386
P3_4_8	<---	subgroup4	.364
P3_4_5	<---	subgroup4	.697
P3_9_6	<---	subgroup5	.543
P3_4_4	<---	subgroup5	.761
P3_4_3	<---	subgroup5	.696
P3_4_1	<---	subgroup6	.550
P3_4_2	<---	subgroup6	.585
P3_4_6	<---	subgroup6	.610
P3_6_3	<---	subgroup6	.663

Table 4.62. Covariances: (Group number 1 - Default model).

Parameter			Estimate	S.E.	C.R.	P	Label
subgroup4	<-->	subgroup5	.269	.043	6.279	***	par_8
subgroup5	<-->	subgroup6	.261	.035	7.444	***	par_9
subgroup4	<-->	subgroup6	.196	.031	6.332	***	par_10

Table 4.63. Correlations: (Group number 1 - Default model).

Parameter			Estimate
subgroup4	<-->	subgroup5	1.125
subgroup5	<-->	subgroup6	.983
subgroup4	<-->	subgroup6	1.142

Table 4.64. Squared Multiple Correlations: (Group number 1 - Default model).

Parameter	Estimate
P3_6_3	.439
P3_4_6	.372
P3_4_2	.342
P3_4_1	.302
P3_4_4	.578
P3_4_3	.484

Table 4.64. Squared Multiple Correlations: (Group number 1 - Default model) (Cont1).

Parameter	Estimate
P3_9_6	.295
P3_4_5	.486
P3_9_1	.149
P3_4_8	.132

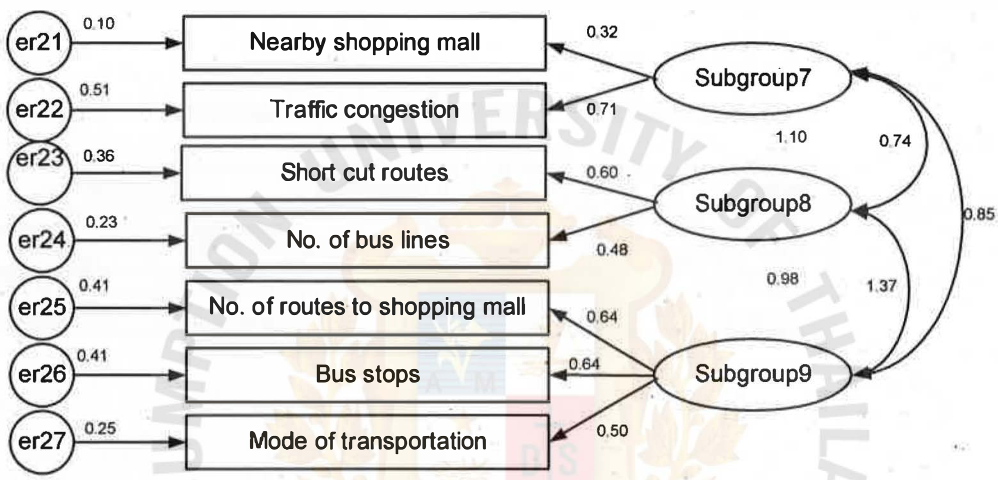

Figure 4.9. Result of the Observed variables within Subgroup 7, 8, 9 (Standardized Estimates).

Table 4.65. Regression Weights: (Group number 1 - Default model).

Parameter			Estimate	S.E.	C.R.	P	Label
P3_8_17	<---	subgroup7	1.000				
P3_1_1	<---	subgroup7	2.043	.468	4.367	***	par_1
P3_1_6	<---	subgroup8	1.000				
P3_1_3	<---	subgroup8	.692	.070	9.858	***	par_2
P3_1_7	<---	subgroup9	1.000				
P3_1_2	<---	subgroup9	.965	.082	11.780	***	par_3
P3_1_4	<---	subgroup9	.675	.071	9.570	***	par_4

Table 4.66. Standardized Regression Weights: (Group number 1 - Default model).

Parameter			Estimate
P3_8_17	<---	subgroup7	.315
P3_1_1	<---	subgroup7	.713
P3_1_6	<---	subgroup8	.600
P3_1_3	<---	subgroup8	.481
P3_1_7	<---	subgroup9	.639
P3_1_2	<---	subgroup9	.640
P3_1_4	<---	subgroup9	.504

Table 4.67. Covariances: (Group number 1 - Default model).

Parameter			Estimate	S.E.	C.R.	P	Label
subgroup7	<-->	subgroup8	.128	.032	3.942	***	par_5
subgroup8	<-->	subgroup9	.492	.050	9.926	***	par_6
subgroup7	<-->	subgroup9	.150	.036	4.182	***	par_7

Table 4.68. Correlations: (Group number 1 - Default model).

Parameter			Estimate
subgroup7	<-->	subgroup8	.735
subgroup8	<-->	subgroup9	1.367
subgroup7	<-->	subgroup9	.851

Table 4.69. Squared Multiple Correlations: (Group number 1 - Default model).

Parameter	Estimate
P3_1_4	.254
P3_1_2	.409
P3_1_7	.408
P3_1_3	.231
P3_1_6	.360
P3_1_1	.509
P3_8_17	.099

The critical values demonstrated in Table 4.65 are different in a highly significant way. After confirming the significance of the regression values, Table 4.66 was used to write the standardized regression weights for Figure 4.9. The covariance critical value in Table 4.67 was also different in a highly significant way, at a confidence level of 99 percent. The equation of subgroup 7, 8, 9 express their relationship as shown in Figure 4.9 as follows:

$$F_{Subgroup7} = 0.32\ f_{Nearby\ shopping\ mall} + 0.71\ f_{Traffic\ congestion} \quad (7)$$

$$F_{Subgroup8} = 0.60\ f_{Short\text{-}cut\ of\ routes} + 0.48\ f_{No.\ bus\ lines} \quad (8)$$

$$F_{Subgroup9} = 0.64\ f_{No.\ routes\ to\ shopping\ mall} + 0.64\ f_{Bus\ stops} + 0.50\ f_{Mode\ of\ transportation} \quad (9)$$

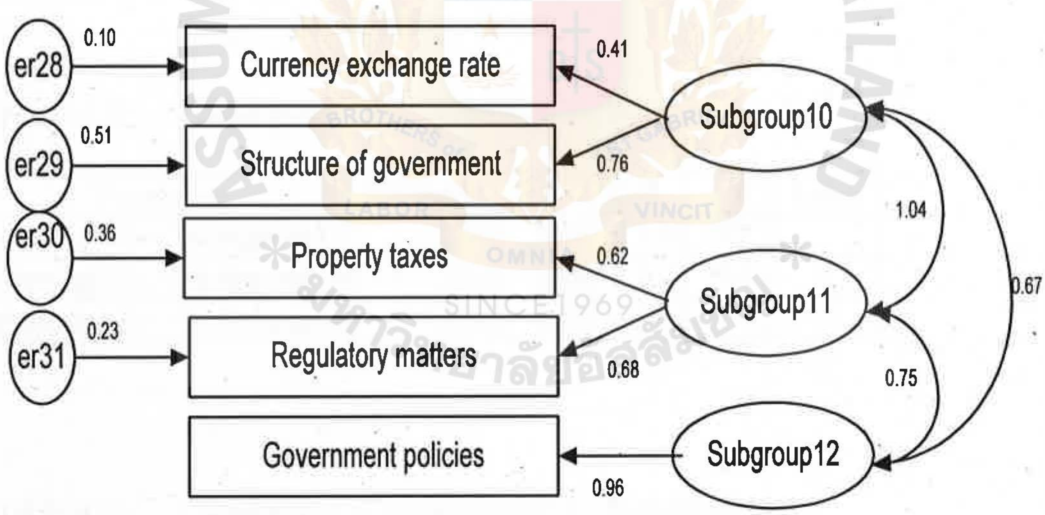

Figure 4.10. Result of the Observed variables within Subgroup 10, 11, 12 (Standardized Estimates).

Table 4.70. Regression Weights: (Group number 1 - Default model).

Parameter			Estimate	S.E.	C.R.	P	Label
P3_4_13	<---	subgroup10	1.000				
P3_7_2	<---	subgroup10	1.999	.280	7.150	***	
P3_7_4	<---	subgroup11	1.000				
P3_7_1	<---	subgroup11	1.146	.104	11.046	***	
P3_7_3	<---	subgroup12	1.000				

Table 4.71. Standardized Regression Weights: (Group number 1 - Default model).

Parameter			Estimate
P3_4_13	<---	subgroup10	.405
P3_7_2	<---	subgroup10	.755
P3_7_4	<---	subgroup11	.619
P3_7_1	<---	subgroup11	.682
P3_7_3	<---	subgroup12	.960

Table 4.72. Covariances: (Group number 1 - Default model).

Parameter			Estimate	S.E.	C.R.	P	Label
subgroup10	<-->	subgroup11	.236	.038	6.190	***	
subgroup12	<-->	subgroup11	.430	.048	9.031	***	
subgroup12	<-->	subgroup10	.290	.047	6.209	***	

Table 4.73. Correlations: (Group number 1 - Default model).

Parameter			Estimate
subgroup10	<-->	subgroup11	1.044
subgroup12	<-->	subgroup11	.750
subgroup12	<-->	subgroup10	.674

The critical values demonstrated in Table 4.70 are different in a highly significant way. After confirming the significance of the regression values, Table 4.71

was used to write the standardized regression weights for Figure 4.10. The covariance critical value in Table 4.72 was also different in a highly significant way, at a confidence level of 99 percent. The equation of subgroup 10, 11, 12 may be stated as shown in Figure 4.10:

$$F_{\text{Subgroup 10}} = 0.41\ f_{\text{Currency exchange rate}} + 0.76\ f_{\text{Structure of government}} \quad (10)$$

$$F_{\text{Subgroup11}} = 0.62\ f_{\text{Property taxes}} + 0.68\ f_{\text{Regulatory matters}} \quad (11)$$

$$F_{\text{Subgroup12}} = 0.96\ f_{\text{Government policies}} \quad (12)$$

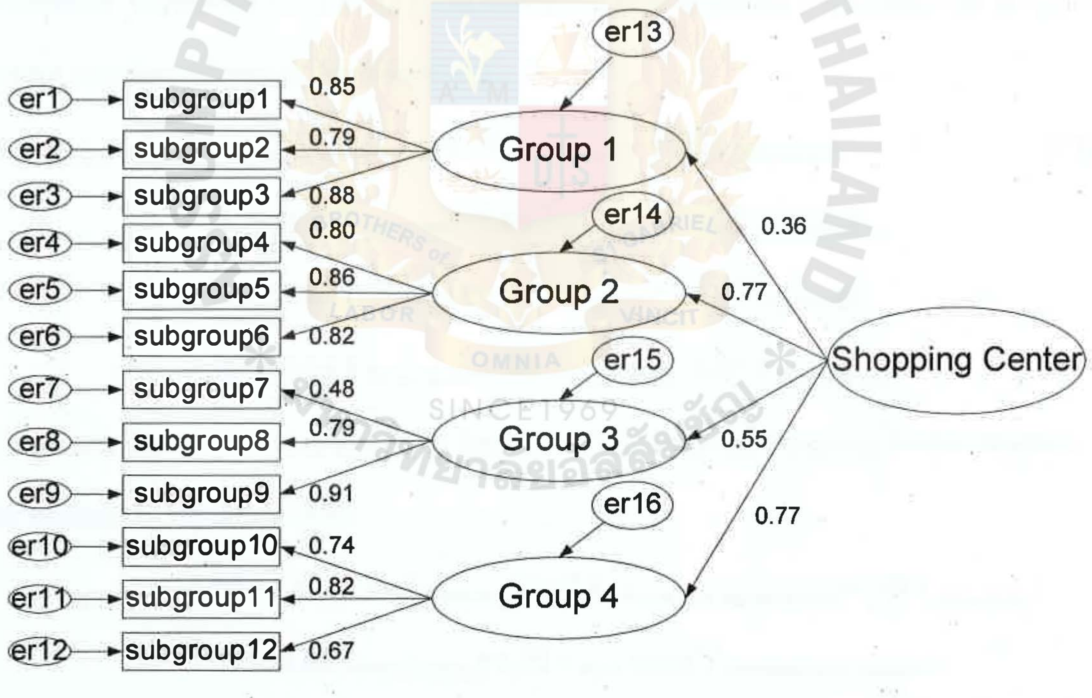

Figure 4.11. Result of the Shopping Center (Standardized Estimates).

Figure 4.11 shows the value of each coefficient factor, which can be formulated in an appropriate mathematical model for the shopping center site selection. The factor group node function can be written in terms of its variables in the shopping center area, as shown in Equations (13) to (16):

$$F_{Group1} = 0.85\ f_{Subgroup1} + 0.79\ f_{Subgroup2} + 0.88\ f_{Subgroup3} \quad (13)$$

$$F_{Group2} = 0.80\ f_{Subgroup4} + 0.86\ f_{Subgroup5} + 0.82\ f_{Subgroup6} \quad (14)$$

$$F_{Group3} = 0.48\ f_{Subgroup7} + 0.79\ f_{Subgroup8} + 0.91\ f_{Subgroup9} \quad (15)$$

$$F_{Group4} = 0.74\ f_{Subgroup10} + 0.82\ f_{Subgroup11} + 0.67\ f_{Subgroup12} \quad (16)$$

The author ferrets out the relationship among the shopping center type. The coefficient was used to represent location, and the function for location alternatives can be written as shown in Equation (17):

$$F_{Shopping\ center} = 0.36\ f_{Group1} + 0.77\ f_{Group2} + 0.55\ f_{Group3} + 0.77\ f_{Group4} \quad (17)$$

Substitute Equations (13), (14), (15), and (16) into Equation (17), then the shopping center function results in Equation (18):

$$\begin{aligned} F_{Shopping\ center} = {} & 0.36(0.85\ f_{Subgroup1} + 0.79\ f_{Subgroup2} + 0.88\ f_{Subgroup3}) \\ & + 0.77(0.80\ f_{Subgroup4} + 0.86\ f_{Subgroup5} + 0.82\ f_{Subgroup6}) \\ & + 0.55(0.48\ f_{Subgroup7} + 0.79\ f_{Subgroup8} + 0.91\ f_{Subgroup9}) \\ & + 0.77(0.74\ f_{Subgroup10} + 0.82\ f_{Subgroup11} + 0.67\ f_{Subgroup12}) \end{aligned} \quad (18)$$

Substitute Equations (1) to (12) into Equation (18), then the shopping center function is formulated in Equation (19):

$$\begin{aligned} F_{Shopping\ center} = {} & 0.36\ \{0.85\{0.53\ f_{Restarants} + 0.57\ f_{Government\ organizations} + 0.88\ f_{Education}\} \\ & + 0.79\{0.63\ f_{Police\ station} + 0.70\ f_{Bank} + 0.68\ f_{Entertainment\ complex}\} \\ & + 0.88\{0.60\ f_{Concert\ hall} + 0.63\ f_{Community\ seat} + 0.65\ f_{Parks} + 0.65\ f_{Hospital}\}\} \\ & + 0.77\ \{0.80\ \{0.36\ f_{Research\ expenditure} + 0.39\ f_{Purchasing\ behavior} \\ & \quad + 0.70\ f_{Inflation\ rate}\} \\ & + 0.86\{0.54\ f_{Immigration\ rate} + 0.70\ f_{No.\ business} + 0.76\ f_{Import\ and\ export\ rate}\} \\ & + 0.82\{0.55\ f_{Household\ Income\ and\ expenditure} + 0.59\ f_{GDP} + 0.61\ f_{Interest\ rate} \end{aligned}$$

$$+0.68\ f_{\text{Flood}}\}\}$$

$$+\ 0.55\{0.48\{0.32\ f_{\text{Nearby shopping mall}}+0.71\ f_{\text{Traffic congestion}}\}$$

$$+0.79\{0.60\ f_{\text{Short-cut routes}}+0.48\ f_{\text{No. of bus lines}}\}$$

$$+0.91\{0.64\ f_{\text{No. routes to shopping mall}}+0.64\ f_{\text{Bus stops}}$$

$$+0.50\ f_{\text{Mode of transportation}}\}\}$$

$$+\ 0.77\{0.74\{0.41\ f_{\text{Currency exchange rate}}+0.76\ f_{\text{Structure of government}}\}$$

$$+0.82\{0.62\ f_{\text{Property taxes}}+0.68\ f_{\text{Regulatory matters}}\}$$

$$+0.67\{0.96\ f_{\text{Government policies}}\}\} \quad (19)$$

Equation (19) is then simplified to obtain the general function for locating a shopping center in Equation (20):

$$F_{\text{Shopping center}} = 0.16\ f_{\text{Restarants}}+0.17\ f_{\text{Government organizations}}+0.27\ f_{\text{Education}}$$

$$+0.18\ f_{\text{Police station}}+0.2\ f_{\text{Bank}}+0.19\ f_{\text{Entertainment complex}}+0.19\ f_{\text{Concert hall}}$$

$$+0.20\ f_{\text{Community seat}}+0.21\ f_{\text{Parks}}+0.21\ f_{\text{Hospital}}+0.22\ f_{\text{Research expenditure}}$$

$$+0.24\ f_{\text{Purchasing behavior}}+0.43\ f_{\text{Inflation rate}}+0.36\ f_{\text{Immigration rate}}$$

$$+0.46\ f_{\text{No. business}}+0.50\ f_{\text{Import and export rate}}+0.35\ f_{\text{Household income and expenditure}}$$

$$+0.37\ f_{\text{GDP}}+0.39\ f_{\text{Interest rate}}+0.43\ f_{\text{Flood}}+\ 0.08\ f_{\text{Nearby shopping mall}}$$

$$+0.19\ f_{\text{Traffic congestion}}+0.26\ f_{\text{Short-cut routes}}+0.21\ f_{\text{No. of bus lines}}$$

$$+0.32\ f_{\text{No. routes to shopping mall}}+0.32\ f_{\text{Bus stops}}+0.25\ f_{\text{Mode of transportation}}$$

$$+\ 0.23\ f_{\text{Currency exchange rate}}+0.43\ f_{\text{Structure of government}}+0.39\ f_{\text{Property taxes}}$$

$$+0.43\ f_{\text{Regulatory matters}}+0.50\ f_{\text{Government policies}} \quad (20)$$

When author substitutes the value of Likert scale 5 into Equation (20), the maximum value of Equation (20) will equal to 46.7. Ohterwise, author substitute the value of Likert scale 1 into Equation (20), the minimum value of Equation (20) will equal to

9.34. Then, author suggests cut off the value for shopping center function at fifty percent at 28.02 to indicate that value can be accepted.

$$F_{\text{Shopping center}} = (0.16\ f_{\text{Restarants}} + 0.17\ f_{\text{Government organizations}} + 0.27\ f_{\text{Education}} + 0.18\ f_{\text{Police station}} + 0.2\ f_{\text{Bank}} + 0.19\ f_{\text{Entertainment complex}} + 0.19\ f_{\text{Concert hall}} + 0.20\ f_{\text{Community seat}} + 0.21\ f_{\text{Parks}} + 0.21\ f_{\text{Hospital}} + 0.22\ f_{\text{Research expenditure}} + 0.24\ f_{\text{Purchasing behavior}} + 0.43\ f_{\text{Inflation rate}} + 0.36\ f_{\text{Immigration rate}} + 0.46\ f_{\text{No. business}} + 0.50\ f_{\text{Import and export rate}} + 0.35\ f_{\text{Household income and expenditure}} + 0.37\ f_{\text{GDP}} + 0.39\ f_{\text{Interest rate}} + 0.43\ f_{\text{Flood}} + 0.08\ f_{\text{Nearby shopping mall}} + 0.19\ f_{\text{Traffic congestion}} + 0.26\ f_{\text{Short-cut routes}} + 0.21\ f_{\text{No. of bus lines}} + 0.32\ f_{\text{No. routes to shopping mall}} + 0.32\ f_{\text{Bus stops}} + 0.25\ f_{\text{Mode of transportation}} + 0.23\ f_{\text{Currency exchange rate}} + 0.43\ f_{\text{Structure of government}} + 0.39\ f_{\text{Property taxes}} + 0.43\ f_{\text{Regulatory matters}} + 0.50\ f_{\text{Government policies}} - 9.34) * ((100-0)/(46.7-9.34))) \quad (21)$$

The resulting shopping center suitability index, $f_{\text{shopping center}}$ in Equation (21) ranges from 0% to 100% with 0 % being the least favorable and 100 % being the most suitable. The function may be used to compare candidate sites of a shopping center. The one with the maximum index represents the most appropriate location. Should there be only one site in consideration, a make-or-break decision may be made based on the resulting value of the suitability index. The index of at least 50 % may serve as a rough acceptance criterion for a single site evaluation. However, this is much discouraged, since the exclusion of other possible locations may seriously downgrade the reliability of site selection. It is recommended that various sites be considered. The best location can thus be based on comparative evaluation of indices among all these candidate sites.

V. CONCLUSIONS AND RECOMMENDATIONS

In this chapter, two sections will be presented. First, the results that show the significance of the research shall be conveyed, which contributes to the dissertation and to the attainment of each target objective. Next, recommendations for further study on urban planning research will be suggested.

5.1 Conclusions

The Hierarchical Facility Network Data Management Model is a systematic method for use in managing location and urban planning data. A two-way approach is established along with a comprehensive location database, used for application to retail industry cases. An analysis of the retail location factors in terms of systematic criteria was done, utilizing one facility level in the hierarchical model for managing facility network data. The model searched journals, books, and websites for all available locations, with sources from 19 ministries and private sectors accessed. Because of the unknown population for this research study, a sampling of 420 was decided upon, with a focus on investors who chose to run their businesses in shopping centers. In addition, factors were identified and evaluated for relevance through peer reviews and reduced through Principal Component Analysis.

SPSS version 12.0 and AMOS 5.0 were utilized to calculate the reliability and validity of the analyzed data, as well as to verify the accuracy of the model results. Location factors were decreased from 95 to 75 through evaluation of the mean, and a structural equation model was developed and later validated through confirmatory factor analysis (CFA). The significant retail location factors were then placed into 4 groups, which were further classified into location-specific and non-location-specific groups.

Location-specific groups reflect location characteristics, features, and environment, all of which directly affect the favorability of the retail location and must be regarded as controllable. Non-location-specific factor groups consist of external business climate and regulatory matters that may indirectly affect the success of retail operations and are also considered uncontrollable factors. It is these factors that can explain why a successful retail location may fail due to changes in economic conditions or governmental policies.

The location-specific factor groups included Group 1 (nearby service facilities) and Group 3 (transportation), while non-location-specific factor groups consisted of Group 2 (economy) and Group 4 (governmental concerns). These two main groups signify their importance to the retail location decision – the best retail site must be identified through using both location-specific (internal) and non-location-specific (external) factors.

Retail managers may evaluate different locations to identify which would be the most suitable site, and a selection based on factor groups depends on how thoroughly the manager considered such factors as location data, user requirements, appropriate location models, how well management forecasts economic trends or future government policies. The retail location factors refer to the fundamental requirements of managing data, which reduces redundancy and ambiguity of responsibilities by offering sufficient information for location planning. The structural equation model conveys the regression weight and correlation that can be used to select a retail location.

5.2 Recommendations

In the 20th century, businesses have been expanding rapidly, giving rise to the critical issue of urban planning. This research attempted to propose a way to structure urban planning within a management model. Facility network data management through hierarchical models was completely constructed to support new information useful for location selection processes. The model then monitored information sources, which demonstrated that it is necessary for the government to provide and enforce policies that directly affect end users. However, the study was limited due to sample size and the number of variables examined. In future researches, the author suggests that open-ended questions may be added to the questionnaire in order to add up the factors. In addition, more than 5 scales can be utilized for the Likert scale in order to provide clear measurement (it must be remembered that the scale number should be odd). Because of differences in development and implementation scope, some factors that were significant in this particular study may not be significant when applied to different facilities, industries, communities, cities, or countries. Further research would have to be done in order to investigate relevant objectives in particular case studies, which could include retail, manufacturing, and service sector functions. In addition, continuing development into other types of facilities entails looking at both the micro and macro scale, in order to see which retail location factors would be feasible to analyze and implement in a real situation.

Researchers could add up-to-date urban location factors for a comprehensive look at the Database Management System (DBMS) level, as location factors that have gone through a validation process can be confidently used by investors and methodologies would be capable of being applied to real cases. Another part of the Hierarchical Facility Network Management Data Model is a Model-Based Management System (MBMS) that classifies factors by data source, which could be categorized into various analytical dimensions including facility, community, city, ministry, primary, secondary, and urban planning views. DBMS and MBMS are utilized with the geographic information system (GIS) to aid in strategic decision-making and empirical research exploring other applications. The technology is powerful in terms of data storage, analysis capabilities, and visualization displays, as it is able to combine information and mapping systems into analytical and modeling tools as well as integrate user requirements within the decision support system.

Researchers should also do an extensive study regarding data storage volume, as this may be an obstacle in the management of data at the macro level. In addition, emphasis could be placed on hardware and software systems that upload information. The direction with which a certain research study takes would depend on the particular city's objectives. Within the local area, the author recommends applying the site map's contribution factors, as a site map enhances and simplifies investors' decision-making. The details of such a map should be in both Thai and English, for more efficiency and effectiveness.

The research methodology used is qualitative analysis based on expert opinions and survey instruments. A fundamental analysis of location selection should also integrate quantitative analysis in as well, especially for the economic groups, as the results would be more effective and efficient in practical terms when combined with this research. While a Hierarchical Facility Network Data Management Model is proposed in this research along with location factors, there is still the fact that its success also depends on its implementation by knowledgeable people. The government should also set training sessions in order to ensure success.

Finally, the author hopes that this dissertation could be further utilized in the grander scheme of urban planning, from the micro level all the way to the macro level.

APPENDIX A

QUESTIONNAIRE FOR RESEARCH STUDY

คำชี้แจง

แบบสอบถามชุดนี้จัดทำขึ้นโดยนักศึกษาปริญญาเอก มีวัตถุประสงค์เพื่อทราบปัจจัยที่ผู้ประกอบการใช้ในการเลือกสถานที่สำหรับเปิดบริษัท / ห้าง / ร้าน ในห้างสรรพสินค้า เพื่อนำข้อมูลมาพัฒนาให้สอดคล้องกับความต้องการของผู้เช่าอย่างแท้จริง และเพื่อใช้เป็นข้อมูลพื้นฐานสำหรับงานวิจัยในการเลือกสถานประกอบการประเภทอื่นๆ ต่อไปทั้งนี้ ผู้วิจัยขอขอบคุณท่านผู้ประกอบการทุกท่านที่สละเวลาทำแบบสอบถามชุดนี้ด้วยความตั้งใจจริง

This questionnaire is set by Ph.D. Candidate, which has objective to know the effective factors during investors make decision for selecting place to open their businesses within Shopping Centers in Bangkok. The data will be use to develop the demand of rental and other objective in site selection.

Therefore, researcher thank the owners intend to devote your time with this questionnaire.

ส่วนที่ 1 คำถามคัดกรอง

Section 1 Screening Question

จำนวนผู้ปฏิเสธการสัมภาษณ์

No. of rejecting interview

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19

ท่านเป็นเจ้าของกิจการใช่หรือไม่

Are you the owner of business?

☐ ใช่ (สัมภาษณ์ต่อ) YES (Continue to interview)

ไม่ใช่ (หยุดสัมภาษณ์) NO (Stop to interview) ☐☐☐☐☐☐☐☐☐☐

ท่านตัดสินใจเลือกสถานที่สำหรับร้านของท่านด้วยตนเองใช่หรือไม่

Do you make decision for select place for your business?

☐ ใช่ (สัมภาษณ์ต่อ) YES (Continue to interview)

ไม่ใช่ (หยุดสัมภาษณ์) NO (Stop to interview) ☐☐☐☐☐☐☐☐☐☐

ส่วนที่ 2 ข้อมูลทั่วไป

Section 2 Demographic Data

ในส่วนนี้เป็นข้อมูลทั่วไปเกี่ยวกับตัวท่าน และกิจการของท่าน ขอให้ท่านกรอกข้อมูลหรือทำเครื่องหมาย ☑ ในช่องว่างที่กำหนดไว้ในแต่ละข้อ

This part is detail of you and your business. Please fill the right mark into the block by use this symbol with the block ☑ in each topic.

อายุของท่าน

Age

☐ ต่ำกว่า 25 ปี Under 25 years old ☐ 25-30 ปี 25-30 years ☐ 31-40ปี 31-40 years

☐ 41-50ปี 41-50 years ☐ 51-60 ปี 51-60 years ☐ 60ปีขึ้นไป Over 60 years

เพศ..

Gender

☐ ชาย male ☐ หญิง Female

สถานภาพการแต่งงาน..

Status

☐ โสด Single ☐ แต่งงาน Married ☐ หย่า / ร้าง / ม่าย / แยกกันอยู่ Devote /Separate

การศึกษาสูงสุดของท่าน

Highest education

☐ ต่ำกว่า ม.6 Under High school ☐ ม.6 / ปวช High School

☐ ปวส./อนุปริญญา Diploma ☐ ปริญญาตรี Bachelor's Degree

☐ ปริญญาโท Master Degree ☐ ปริญญาเอก Doctorate

☐ อื่นๆ ระบุ Other..

ประเภทของกิจการของท่าน

Type of business ....

ระยะเวลาที่ท่านเช่าพื้นที่ทำกิจการนาน

How long do you rent this floor ....ปี years.......เดือน Months

มีสาขาจำนวน

Amount of branches ....สาขา branches

มีพนักงานทั้งหมดประมาณ.

Amount of employees.........................คน persons

ทุนจดทะเบียน

Capital ....บาท Baht

Section 3 Weighting of each factors, which have effect to decision making the new location with shopping Centers

ส่วนที่ 3 ระดับความสำคัญของปัจจัยที่มีผลต่อการเลือกลงทุนซื้อหรือเช่าพื้นที่ในห้างสรรพสินค้าทั่วกรุงเทพฯ โดยให้ท่านเลือกระดับความสำคัญของแต่ละปัจจัย

มี 5 ระดับคือ 5 = Extremely High Extent สำคัญมากที่สุด

4 = Fairly High Extent สำคัญมาก

3 = Neutral สำคัญปานกลาง

2 = Fairly Low Extent สำคัญน้อย และ

1 = Extremely Low Extent สำคัญน้อยที่สุด

ปัจจัยที่มีผลกระทบต่อการลงทุน	ระดับความสำคัญตามความคิดเห็นของท่าน Weight from your opinion				
	5	4	3	2	1
3.1.1 Traffic congestion การจราจรบริเวณห้างฯ					
3.1.2 Bus stops ป้ายรถเมล์บริเวณห้างฯ					
3.1.3 No. of bus lines จำนวนสายของรถเมล์ที่ผ่านห้างฯ					
3.1.4 Mode of transportation ลักษณะการเดินทาง					
3.1.5 Proximity to the shopping center ระยะทางในการเดินทางใกล้ / ไกล					
3.1.6 Short cut routes เส้นทางลัดในการเดินทางไปห้างฯ					
3.1.7 Available routes to the shopping center มีเส้นทางให้เลือกเดินทางไปห้างฯ หลายเส้นทาง					
3.1.8 No. of traffic lanes ถนนบริเวณห้างฯ มีหลายเลน					
3.1.9 Type of road surface ลักษณะ ชนิดของพื้นถนนบริเวณห้างฯ					
3.2.1 Labor quality คุณภาพของแรงงานบริเวณโดยรอบห้างฯ					
3.2.2 Labor supply ปริมาณแรงงานในร้าน / บริษัทใกล้ห้างฯ					
3.2.3 Labor skills ความรู้ของพนักงานในแต่ละพื้นที่					
3.2.4 Labor attitude ทัศนคติในการทำงานของคนในแต่ละพื้นที่					
3.3.1 Nearby service facilities มีธุรกิจบริการเช่น บริการซ่อมแซม ติดตั้งอุปกรณ์โดยรอบห้างฯ					
3.3.2 Proximity to head office ห้างฯ ตั้งอยู่ใกล้กับบริษัทแม่					

ปัจจัยที่มีผลกระทบต่อการลงทุน	ระดับความสำคัญตามความคิดเห็นของท่าน Weight from your opinion				
	5	4	3	2	1
3.3.3 Proximity to suppliers ห้างตั้งอยู่ใกล้แหล่งสินค้าและวัตถุดิบ					
3.4.1 Household income and expenditure รายได้และค่าใช้จ่ายเฉลี่ยต่อเดือนของครัวเรือน					
3.4.2 GDP ผลิตภัณฑ์มวลรวม (ปริมาณการผลิตสินค้าของประเทศต่อปี)					
3.4.3 No. businesses, closures, and existence จำนวนผู้จดทะเบียน สิ้นสภาพ และคงอยู่ของบริษัท					
3.4.4 Import and export rate อัตราการนำเข้า / ส่งออกของสินค้า					
3.4.5 Inflation rate อัตราเงินเฟ้อ					
3.4.6 Interest rate อัตราดอกเบี้ย					
3.4.7 Product pricing การเปลี่ยนแปลงของราคาสินค้า					
3.4.8 Research/operation expenditure ค่าดำเนินการวิจัย, ค่าติดต่อดำเนินกิจการ					
3.4.9 Rental costs ค่าเช่าสถานที่					
3.4.10 Construction costs ค่าก่อสร้าง/ตกแต่งร้าน/บริษัท					
3.4.11 Land costs ราคาที่ดิน					
3.4.12 Investment capitals จำนวนเงินที่ใช้ลงทุน					
3.4.13 Currency exchange rate อัตราแลกเปลี่ยนเงินตราระหว่างประเทศ					
3.5.1 Phone/ internet services ระบบโทรศัพท์ อินเตอร์เน็ทภายในห้างฯ					
3.5.2 Type of energy ประเภทของพลังงาน เช่น ไฟฟ้า, แก๊ส, น้ำมันที่ใช้ในห้างฯ					
3.5.3 Quality of water and sewerage system คุณภาพของน้ำ และระบบน้ำทิ้งในห้างฯ					
3.5.4 Available parking space ที่จอดรถภายในห้างฯ					
3.5.5 Available restrooms **ห้องน้ำภายในห้างฯ**					
3.5.6 Ventilation system ระบบไหลเวียนอากาศภายในห้างฯ					
3.6.1 Air pollution มลภาวะทางอากาศ					

ปัจจัยที่มีผลกระทบต่อการลงทุน	ระดับความสำคัญตามความคิดเห็นของท่าน Weight from your opinion				
	5	4	3	2	1
3.6.2 Noise pollution มลภาวะทางเสียง					
3.6.3 Flood อุทกภัยทางน้ำ, น้ำท่วม					
3.7.1 Regulatory matters ระบบกฎหมาย (การส่งเสริมการลงทุน, กฎหมายต่างๆ)					
3.7.2 Regime โครงสร้างรัฐบาล เช่น รัฐบาลพรรคเดียว, พรรคร่วม					
3.7.3 Government policies นโยบายของรัฐบาล					
3.7.4 Taxes ภาษีโรงเรือน, ภาษีที่ดิน					
3.8.1 Used products shops ร้านขายของมือสองราคาต่ำ					
3.8.2 Massage parlor สถานบริการอาบอบนวด					
3.8.3 Hotels โรงแรม					
3.8.4 Education institutions โรงเรียน/มหาวิทยาลัย					
3.8.5 Parks and recreational facilities สวนสาธารณะหรือสถานที่พักผ่อนหย่อนใจ					
3.8.6 Governmental organizations สถานที่ราชการ เช่น กรม,กอง,กระทรวง					
3.8.7 Community seat แหล่งที่อยู่อาศัย/ชุมชน					
3.8.8 Libraries หอสมุด/ห้องสมุด					
3.8.9 Fire stations สถานีดับเพลิง					
3.8.10 Foundations มูลนิธิต่างๆ					
3.8.11 Post offices ที่ทำการไปรษณีย์					
3.8.12 Police stations สถานีตำรวจ					
3.8.13 Religious facilities (Temples, churches, etc.) วัด, มัสยิด , ศาลเจ้า,โบสถ์					
3.8.14 Fresh markets ย่านตลาดสด					
3.8.15 Drug stores ร้านขายยา					

ปัจจัยที่มีผลกระทบต่อการลงทุน	ระดับความสำคัญตามความคิดเห็นของท่าน Weight from your opinion				
	5	4	3	2	1
3.8.16 Restaurants/ cafeterias ภัตตาคาร, ร้านอาหาร					
3.8.17 Nearby shopping center ศูนย์การค้าหรือห้างฯอื่น					
3.8.18 Hospitals โรงพยาบาล					
3.8.19 Banks ธนาคาร					
3.8.20 Mini marts มินิมาร์ท					
3.8.21 Industrial area โรงงานอุตสาหกรรมต่าง ๆ					
3.8.22 Warehouse, godown คลังสินค้า, โกดัง					
3.8.23 Sports facilities สนามกีฬา, โรงยิม					
3.8.24 Entertain complex สถานที่ท่องเที่ยว/บันเทิง เช่น โรงภาพยนตร์, ร้านเกมส์					
3.8.25 Insurance company บริษัทประกันภัย					
3.8.26 Concert exhibition halls สถานที่จัดงานแสดง เช่น คอนเสิร์ต, นิทรรศการ, งานโชว์					
3.8.27 Nearby retail stores คู่แข่งในบริเวณที่ตั้งห้างฯ					
3.8.28 Airports สนามบิน					
3.8.29 Gas stations ปั้มน้ำมัน					
3.9.1 Purchasing behavior ลักษณะการจับจ่ายของลูกค้า					
3.9.2 Response of customer to new shopping center การตอบสนองกับห้างสรรพสินค้าเปิดใหม่ของลูกค้า					
3.9.3 Amount of sales in the area แนวโน้มยอดขายในพื้นที่					
3.9.4 Product variety ความหลากหลายของสินค้า					
3.9.5 Population อัตราประชากรในพื้นที่					
3.9.6 Immigration/ emigration rate จำนวนคนเข้า/ออกในประเทศ					
3.9.7 Community attitude ทัศนคติของชุมชน/สังคมบริเวณพื้นที่					

ปัจจัยที่มีผลกระทบต่อการลงทุน	ระดับความสำคัญตามความคิดเห็นของท่าน Weight from your opinion				
	5	4	3	2	1
3.9.8 Size of shopping center ขนาดของห้างสรรพสินค้า					
3.9.9 Design/decoration ลักษณะการตกแต่ง/สีสันของห้างฯ					
3.9.10 Location within shopping center ตำแหน่งทำเลเช่าภายในห้างฯ					
3.9.11 Expansion space พื้นที่ว่างสำหรับการขยายกิจการในอนาคต					
3.9.12 Type of ownership (rent, own, lease) ลักษณะการเป็นเจ้าของพื้นที่ เช่น เช่า,ซื้อ,เซ้ง					
3.9.13 Zoning การแบ่งเขตการค้าแต่ละประเภท(โซน)					
3.9.14 Security ความปลอดภัยบริเวณห้างฯ					
3.9.15 Strategic and policies ประสิทธิภาพการบริหารในส่วนกลางของห้างฯ					
3.9.16 Local culture ประเพณีของท้องถิ่น					
3.9.17 Local languages ภาษาของคนท้องถิ่น					
3.9.18 Race/ nationality เชื้อสายของคนท้องถิ่น					
3.9.19 Fengshui ฮวงจุ้ย					
3.9.20 Technology changes การเปลี่ยนแปลงทางเทคโนโลยี					
3.9.21 Fashion trend แฟชั่นแต่ละช่วงเวลา					
3.9.22 Advertising media สื่อโฆษณา เช่น ป้ายโฆษณา, โทรทัศน์, วิทยุ, หนังสือพิมพ์,นิตยสาร					
3.9.23 War/ revolution สงครามและการปฏิวัติ					
3.9.24 Terrorism ภัยก่อการร้าย					
3.9.25 Other…….. อื่นๆ………………………………………………………………… …………					
3.9.26 Other…….. อื่นๆ………………………………………………………………… …………					
3.9.27 Other…….. อื่นๆ………………………………………………………………… …………					

APPENDIX B

WEBSITE FOR SEARCH DATA

Table B.1. Website of Ministries and Private Sources.

Ministry of Defence	Websites
Office of the Permanent Secretary for Defence	http://www.mod.go.th
Royal Aide-de-Cam Department Ministry of Defence	http://www.radc.go.th/
Royal Thai Army (RTA)	http://www.rta.mi.th
Royal Thai Navy	http://www.navy.mi.th
Supreme Command Headquarters	http://www.schq.mi.th
Thai Air Force	http://www.rtaf.mi.th
Ministry of Finance	
Excise Department	http://www.exd.mof.go.th
Fiscal Policy Office	http://www.fpo.go.th
Office of The Secretary to The Minister, Ministry of Finance	http://www.mof.go.th/
Public debt management office	http://www.pdmo.mof.go.th/
Revenue Department	http://www.rd.go.th
State Enterprise Policy Office	http://www.privatisation.go.th
The Comptroller General's Department	http://www.cgd.mof.go.th/
The Customs Department	http://www.customs.go.th
The Treasury Department	http://www.treasury.go.th
Ministry of Foreign Affairs	
Department of ASEAN Affairs	http://www.aseansec.org
Department of South Asian, Middle East and African Affairs	http://www.mfa.go.th
Ministry of Tourism and Sports	
Bureau of Welfare Promotion and Protection of Children	http://www.opp.go.th
Department of Social Development and Welfare	http://www.dsdw.go.th
Office of Permanent Secretary	http://www.mts.go.th
Office of Sports and Recreation Development	http://www.mots.go.th
Office of Tourism Development	http://www.tourism.go.th
Women's Affairs and Family Development	http://www.women-family.go.th
Ministry of Social Development and Human Security	http://www.m-society.go.th
Ministry of Agriculture and Co-operatives	
Agricultural Land Reform	http://www.alro.go.th
Corporative Auditing Department	http://www.cad.go.th
Department of Agricultural	http://www.doa.go.th
Department of Agricultural extension	http://www.doae.go.th
Department of Fisheries	http://www.fisheries.go.th
Department of Livestock Development	http://www.dld.go.th
Land Development Department	http://www.ldd.go.th
National Bureau of Agricultural Commodity and Standards(ACFS)	http://www.acfs.go.th
Office of Agricultural Economics	http://www.oae.go.th

Table B.2. Website of Ministries and Private Sources (Cont.1).

Ministry of Agriculture and Co-operatives	Websites
Office of The Secretary to Ministry of Agriculture Co-operative	http://www.moac.go.th
Royal Forest Department	http://www.forest.go.th
Royal Irrigation Department	http://www.rid.go.th/
The Cooperative Promotion Department	http://www.cpd.go.th
Ministry of Transport and Communications	
Department of Aviation	http://www.aviation.go.th
Department of Highways	http://www.doh.motc.go.th
Department of Land Transport	http://www.dlt.motc.go.th
Department of rural roads	http://www.dor.go.th
Marine Department	http://www.md.go.th
Ministry of Transport and Communications	http://www.mot.go.th
Ministry of Natural Resources and Environment	
Department of Environmental Quality Promotion	http://www.deqp.go.th
Department of Groundwater Resources	http://www.dgr.go.th/
Department of Marine and Coastal Resources	http://www.dmcr.go.th/
Department of Water Resources	http://www.dwr.go.th
National Park, Wildlife and Plant Conservation Department	http://www.dnp.go.th
Office of Environmental Policy and Planning	http://www.oepp.go.th/
Office of the Secretary to the Ministry	http://www.mot.go.th
Pollution Control Department	http://www.pcd.go.th
Ministry of Information Technology and Communications	
Meteorological Department	http://www.tmd.go.th
Ministry Of Information and Communication Technology	http://www.ict.go.th
National Statistical Office	http://www.nso.go.th
The Communications Authority of Thailand	http://www.cat.or.th
The Post and Telegraph Department	http://www.ptd.go.th/
Ministry of Information Technology and Communications	Websites
TOT Corporation Public Company Limited	http://www.tot.or.th/
Ministry of Energy	
Department of Mineral Fuels	http://www.dmf.go.th/
Department of the Energy Development and Promotion	http://www.dedp.go.th
Energy Policy and Planning Office Ministry of Energy	http://www.eppo.go.th
Ministry of Energy	http://www.energy.go.th
PTT Public Company Limited	http://www.pttplc.com
Ministry of Commerce	

Table B.3. Website of Ministries and Private Sources (Cont.2).

Department of Commercial Registration	http://www.thairegistration.com
Department of Export Promotion	http://www.depthai.go.th
Department of Foreign Trade Ministry of Commerce	http://www.dft.go.th
Department of Insurance	http://www.doi.go.th
Department of Intellectual Property	http://www.ipthailand.org
Department of Internal Trade	http://www.dit.go.th
Department of Trade Negotiations	http://www.dtn.moc.go.th
Office of Permanent Secretary Ministry of Commerce	http://www.moc.go.th
Ministry of Interior	
Community Development Department	http://www.cdd.moi.go.th
Department of Disaster Prevention and Mitigation (DPM)	http://www.disaster.go.th/
Department of Lands	http://www.dol.go.th/
Department of Local Administration	http://www.dola.go.th/
Office of the Permanent Secretary for Interior	http://www.moi.go.th
Public Works Department	http://www.pwd.go.th
Ministry of Justice	
Central Institute of Forensic Science	http://www.cifs.moj.go.th/
Department of Corrections	http://www.correct.go.th
Department of Juvenlle Observation and Protection	http://www.djop.moj.go.th
Department of Probation	http://www.probation.go.th
Legal Execution Department	http://www.led.go.th
Office of The Narcotics Control Board	http://www.oncb.go.th
Office of the Secretary Ministry of Justice	http://www.moj.go.th/
Right and Liberties Protection Department	http://www.rlpd.go.th
Department of Employment	http://www.doe.go.th
Department of Labor Protection and Welfare	http://www.labour.go.th
Department of Skill Development	http://www.dsd.go.th
Office of the Permanent for Ministry of Labor and Social Welfare	http://www.molsw.go.th
Office of the Secretary to the Minister	http://www.molsw.go.th
Social Security Office	http://www.sso.molsw.go.th
Ministry of Culture	
Ministry of Culture	http://www.m-culture.go.th
Office of the National Culture Commission	http://www.culture.go.th
The Fine Arts Department	http://www.finearts.go.th/
The Religious Affairs Department	http://www.moe.go.th/webrad/
Ministry of Science Technology and Environment	
Department of Science Service	http://www.dss.go.th
Ministry of Science and Technology	http://www.most.go.th

Table B.4. Website of Ministries and Private Sources (Cont.3).

Ministry of Labor and Social Welfare	Websites
National Center for Genetic Engineering and Biotechnlogy (BIOTEC	http://www.biotec.or.th
National Institute of Metrology (Thailand	http://www.nimt.or.th
National Metal and Materials Technology Center (MTEC	http://www.mtec.or.th/th/index.asp
National Science and Technology Development Agency	http://www.nstda.or.th
Office of Atomic Energy for Peace	http://www.oaep.go.th
Office of Technology Promotion and Transfer	http://www.moste.go.th
Office of the Secretary to the Minister	http://www.moste.go.th
Regional Environmental office 1-12	http://www.moste.go.th/about/structure.html
Technical Information Access Center	http://www.tiac.or.th
National Synchrotron Research Center	http://www.nsrc.or.th
Ministry of Education	
Department of Curriculum and Instruction Development	http://www.moe.go.th
Department of General Education	http://www.ge.go.th
Department of Non-Formal Education	http://www.nfe.go.th
Department of Vocational Education	http://www.dovenet.moe.go.th
Mahachulalongkornrajavidyalaya University	http://www.mcu.ac.th
Office of Teacher Civil Service Commission (OTCSC)	http://www.moe.go.th/webtcs/
Office of the National Primary Education Commission	http://www.onpec.moe.go.th/
Office of the Private Education Commission	http://www.opec.go.th
Office of the Secretary to the Minister	http://www.moe.go.th
Rajamangala Institute of Technology	http://www.rit.ac.th/
Ministry of Public Health	
Department for Development of Thai Traditional and Alternative Medicine	http://203.157.19.1/dtam/index.htm
Department of Health	http://www.anamai.moph.go.th/
Department of Medical Sciences	http://www.dmsc.moph.go.th
Department of Medical Services Ministry of Public Health	http://www.dms.moph.go.th
Department of Mental Health	http://www.dmh.moph.go.th/
Food and Drug Administration	http://www.fda.moph.go.th
Office of the Permanent Secretary	http://www.moph.go.th
Ministry of Industry	
Department of Industrial Promotion	http://www.smethai.net
Department of Industrial Works	http://www.diw.go.th
Office of Industrial Economics	http://www.oie.go.th

Table B.5. Website of Ministries and Private Sources (Cont.4).

Ministry of Education	Websites
Office of The Board of Investment	http://www.boi.go.th
Office of the Cane and Sugar Board	www.ocsb.go.th/sugar2001/index2001.htm
Office of the Secretary to the Minister, Ministry of industry	http://www.industry.go.th
Thai Industrial Standards Institute	http://www.tisi.go.th
Organizations	
Department of Drainage & Sewerage	http://www.bma.go.th
Health Department	http://pxd2000.cjb.net/
National Economic and Social Advisory Council	http://www.nesac.or.th/
Office of the Auditor General of Thailand	http://www.oag.go.th
Office Of The BMA Civil Service Commission	http://www.bma.go.th/intranet/civilservicecommission/Index.gtml
Office of the Election Commission of Thailand (OECT)	http://www.ect.go.th
Office Of the National Counter Corruption Commission	http://nccc.thaigov.net
The National Human Rights Commission of Thailand	http://www.nhrc.or.th
Office of the Election Commission of Thailand (OECT)	http://www.ect.go.th
The National Human Rights Commission of Thailand	http://www.nhrc.or.th
Aeronautical Radio of Thailand Ltd.	http://www.aerothai.com ,
Airports of Thailand Public Company Limited	http://www.airportthai.co.th
Bangkok Mass Transit Authority	http://www.bmta.go.th
Bank for Agriculture and Agricultural Co-operatives	http://www.baac.or.th
Bank of Thailand	http://www.bot.or.th
Civil Aviation Training Center	http://www.catc.or.th/
Crown Property Bureau	http://www.crownproperty.or.th/thai_version/index.html
Electricity Generation Authority of Thailand	http://www.egat.or.th
Export - Import Bank of Thailand (EXIM Thailand)	http://www.exim.go.th
Express Transportation Organization of Thailand	http://www.eto.motc.go.th
Expressway and Rapid Transit Authority of Thailand	http://www.eta.or.th
Industrial Estate Authority of Thailand	http://www.ieat.go.th
Islamic Bank of Thailand	http://www.isbt.co.th
Krung Thai Bank Public Company Limited	http://www.ktb.co.th
Kurusapa Business Organization	http://www.suksapan.or.th
Mass Communication Organization Of Thailand	http://www.mcot.or.th/

Table B.6. Website of Ministries and Private Sources (Cont.5).

Organizations	Websites
Mass Rapid Transit Authority of Thailand	http://www.mrta.or.th
Merchant Marine Training Centre	http://www.thai.net.mmtc
Metropolitan Waterworks Authority	http://www.mwa.or.th
Metropolitan Electricity Authority	http://www.mea.or.th
Narai Phand Co.,Ltd.	http://www.naraiphand.com
National Housing Authority	http://www.nhanet.or.th
New Bangkok International Airport Company Limited	http://www.bangkokairport. org
Office of the Rubber Replanting Aid Fund	http://www.thailandrubber.thaigov. net/
Playing Cards Factory Excise Department	http://www.exd.mof.go.th/playingc ard/
Port Authority of Thailand	http://www.port.co.th
Provincial Electricity Authority	http://www.pea.or.th
Provincial Waterworks Authority	http://www.pwa.thaigov.net
Public Warehouse Organization	http://www.publicwarehouse.org
Queen Sirikit Botanic Garden	http://www.thaigov.go.th/QSB.htm
Rubber Estate Organization Ministry of Agriculture & Cooperative Thailand	http://www.reothai.com
Rubber Research Institute	http://www.rubberthai.com
Small Industry Credit Guarantee Corporation	http://www.sicgc.or.th/
Secondary mortgage Corporation	http://www.smcthailand.com
Small and Medium Enterprise Development Bank of Thailand	http://www.smebank.co.th
State Railway of Thailand	http://www.srt.or.th/
Thai Airways International Public Company Limited	http://www.thaiairways.com
Thai Maritime Navigation Company Limited	http://www.tmn.co.th
Thailand Institute of Scientific and Technological Research	http://www.tistr.or.th
Thailand Tobacco Monopoly	http://www.thaitobacco.or.th
The Battery Organization	http://www.powerbattery.org/
The Government Lottery Office	http://www.glo.or.th
The Marketing Organization	http://www.mo.moi.go.th/
The Marketing Organization for Farmers (MOF)	http://www.moac.go.th/struct_mof. htm
The Office of the Securities and Exchange Commission	http://www.sec.or.th/index.php
The Tanning Organization	http://www.tto.or.th
The Zoological Park Organization	http://www.zoothailand.org
Wastewater Management Authority	http://www.wma.or.th
Aids Access Foundation	http://www.aidsaccess.com

Table B.7. Website of Ministries and Private Sources (Cont.6).

Organizations	Websites
Community Organizations Development Institute (Public Organization)	http://www.codi.or.th
Duang Prateep Foundation	http://www.dpf.or.th/Thai
Foundation For Children	http://www.ffc.or.th
Geo-Informatics and Space Technology Development Agency (Public Organization	http://www.gistda.or.th
Greenpeace Southeast Asia (Thailand)	http://www.greenpeacesoutheastasia.org/th/index.html
khurusapha	http://www.khurusapha.or.th
Mae Fah Luang Foundation Under Royal Patronage	http://www.doitung.org
Princess Maha Chakri Sirindhorn Anthropology Centre (Public Organization)	http://www.sac.or.th/
Seub Nakhasathin Foundation Thailand	http://www.seub.or.th
Thai Disabled Development Foundation	http://www.tddf.or.th
Thai Health Promotion Foundation	http://www.healthnet.in.th/
Thai Society for the Prevention of Cruelty to Animals	http://www.thaispca.org/index.php
The Center for the Protection of Children's Rights Foundation	http://www.thaichildrights.org/
The Chaipattana Foundation	www.chaipat.or.th
The Home for the Blind with Multi-Handicapped	http://child1000.web1000.com/indexth.htm
The Human Development Foundation	http://www.fatherjoe.org/default_th.asp
The Institute for the Promotion of Teaching Science and Technology	http://www.ipst.ac.th
The National Council on Social Welfare of Thailand	http://www.ncswt.or.th
The Office for National Education Standards and Quality Assessment	http://www.onesqa.or.th
Think Earth Environmental Education Foundation	http://www.thinkearth.org
UNESCO Asia and Pacific Regional Bureau for Education (UNESCO Bangkok)	http://www.unescobkk.org
Wildlife Trade Campaign	http://www.wwfthai.org/home/
Worldvision	http://www.worldvision.or.th
Anti-Money Laundering Office (AMLO	http://www.amlo.go.th
Bangkok Aviation Fuel Services Public Company Limited [BAFS	http://www.bafsthai.com
Bureau of the Royal Household	http://www.palaces.thai.net
Dhipaya Insurance Public Company Limited	http://www.dhipaya.co.th
Government Pension Fund	http://www.gpf.or.th
National Olympic Committee of Thailand [NOCT]	http://www.olympicthai.or.th
National Research Council of Thailand	http://www.nrct.go.th

Table B.8. Website of Ministries and Private Sources (Cont.7).

Organizations	Websites
Royal Thai Police	http://www.police.go.th
SMEs and P Financial Advisory Center	http://www.sfac.or.th/
The Law Society of Thailand	http://www.lawsociety.or.th/indexth.html
The office of The Royal Development Projects Board	http://www.rdpb.go.th
The Royal Institute	http://www.RoyIn.go.th
The Secretariat of the House of Representatives	http://www.parliament.go.th/files/about/t-c12.htm
The Secretariat of the Senate	http://www.parliament.go.th
The Thaibar	http://www.thethaibar.thaigov.net/
The Thailand Research Fund (TRF)	http://www.trf.or.th
Council of Engineers (COE)	http://www.coe.or.th
Council of Thai Architects	http://www.thaiarchitects.org
Professional Tourist Guide Association Thailand	http://www.pgathaitouristguide.org
Thai Pilots Associations	http://www.thaipa.org , http://www.thaipilot.com
Thailand Nursing Council	http://www.tnc.or.th
The Association of Medical Technologist of Thailand	http://www.amtt.org/home.asp
The Dental Council	http://www.dentalcouncil.or.th
The Institute of Certified Accountants and Auditors of Thailand	http://www.icaat.or.th
The Institute of Internal Auditors of Thailand (IIAT)	http://www.theiiat.or.th
The Medical Council	http://www.tmc.or.th/main/index.php
The Pharmacy Council	http://www.pharmacycouncil.org/index.php

APPENDIX C

LIST OF LOCATION FACTORS

Table C.1. Eight Critical Factors of Quality Management in a Business Unit. (Badri, 1995)

Factor 1: Role of divisional top management and quality policy	
1	Extent to which the top division executive assumes responsibility for quality performance.
2	Acceptance of responsibility for quality by major department heads within the division.
3	Degree to which divisional top management is evaluated for quality performance.
4	Extent to which the division top management supports long-term quality improvement process.
5	Degree of participation by major department heads in the quality improvement process.
6	Extent to which the divisional top management has objectives for quality performance.
7	Specificity of quality goals within the division.
8	Comprehensiveness of goal-setting process for quality within the division.
9	Extent to which quality goals and policy are understood within the division.
10	Importance attached to quality by the divisional top management in relation to cost and quality objectives.
11	Amount of review of quality issues in divisional top management meetings.
12	Degree to which the divisional top management considers quality improvements as a way to increase profit.
13	Degree of comprehensiveness of the quality plan within the division.
Factor 2: Role of the quality department	
14	Visibility of the quality department.
15	Quality department's access to divisional top management.
16	Autonomy of the quality department.
17	Amount of co-ordination between the quality department and other departments.
18	Effectiveness of the quality department in improving quality.
Factor 3: Training	
19	Specific work skills training given to hourly employees throughout the division.
20	Quality-related training given to hourly employees throughout the division.
21	Quality-related training given to managers and supervisors throughout the division.
22	Training in the "total quality concept" throughout the division.
23	Training in the basic statistical techniques in the division as a whole.
24	Training in advanced statistical techniques in the division as a whole.
25	Commitment of the divisional top management to employee training.
26	Availability of resources for employee training in the division.
Factor 4: Product/service design	
27	Thoroughness of new product/service design review before the product/service is produced and marketed.
28	Co-ordination among affected departments in the product/service development process.
29	Quality of new products/services emphasized in relation to cost or schedule objectives.
30	Clarity of product/service specifications and procedures.
31	Extent to which implementation is considered in the product/service design process.
32	Quality emphasis by sales, customer service, marketing, and PR personnel.
Factor 5: Supplier quality management	
33	Extent to which suppliers are selected based on quality rather than price of schedule.
34	Thoroughness of the supplier-rating system.
35	Reliance on reasonably few dependable suppliers.
36	Amount of education of supplier by division.
37	Technical assistance provided to the supplier.
38	Involvement of the supplier in the product development process.
39	Extent to which longer-term relationships provided to suppliers.
40	Clarity of specifications provided to suppliers.

Table C.1. Eight Critical Factors of Quality Management in a Business Unit. (Badri, 1995) Contl.

Factor 6: Process management/operating procedures	
41	Use of acceptance sampling to accept/reject lots or batches of work.
42	Amount of preventive equipment maintenance.
43	Extent to which inspection, review, or checking of work is automated.
44	Amount of incoming inspection, review, or checking.
45	Amount of in-process inspection, review, or checking.
46	Amount of final inspection, review, or checking.
47	Stability of production schedule/work distribution.
48	Degree of automation in the process.
49	Extent to which process design is "fool-proof" and minimizes the chances of employee errors.
50	Clarity of work or process instructions given to employees.
Factor 7: Quality data and reporting	
51	Availability of cost of quality data in the division.
52	Availability of quality data.
53	Timeliness of the quality data.
54	Extent to which quality data are used as tools to manage quality.
55	Extent to which quality data are available to hourly employees.
56	Extent to which quality data are available to managers and supervisors.
57	Extent to which quality data are used to evaluate supervisorial and managerial performance.
58	Extent to which quality data are displayed at employee work stations.
Factor 8: Employee relations	
59	Extent to which quality circle or employee involvement type programmes are implemented in the division.
60	Effectiveness of quality circle or employee involvement type programmes in the division.
61	Extent to which employees are held responsible for error-free output.
62	Amount of feedback provided to employees in their quality performance.
63	Degree of participation in quality decisions by hourly/non-supervisory employees.
64	Extent to which quality awareness building among employees is ongoing.
65	Extent to which employees are recognized for superior quality performance.
66	Effectiveness of supervisors in solving problems/issues.

Table. C.2. Critical Success Factors for International Development Projects. (Kwak,2002)

No.	Factors	Characteristics	Impact
1	Political	Inconsistency in policies and regulations; political instability, war, revolution; import restrictions. Low probability, high impact.	Environment of uncertainty on return on investment
2	Legal	Unexpected changes in laws and regulations policies; currency conversion; lack of appropriate regulatory systems; role of local courts in arbitration.	Lack of conductive environment to foreign investments; Restricted technology transfer.
3	Cultural	Differing social-cultural background of stakeholders; different thought process.	Conflict of interest and extra pressure on executives; inefficient use of resources
4	Technical	Use of technology incompatible with project; use of incompatible standards for manufacturing and services.	Under performing or unsustainable project; stakeholder dissatisfaction.
5	Managerial/ Organizational	Inadequate or ineffective project management; lack of appropriate processes or resources.	Project failure; stakeholder dissatisfaction.
6	Economical	Changes in domestic economic conditions; increased competition; regulatory changes.	Project unsustainable or cancelled.
7	Environmental	Pollution-noise, air, water, visual; unsustainable use of natural resources.	Environmental degradation; social resistance to economic changes
8	Social	Ethnic hostility; religious fragmentation; security of stakeholders; resistance of beneficiaries to new social values.	Lack of foreign investment or technology flow.
9	Corruption	Political participation in investment decision making; lack of regulatory institutions.	Ineffective use of development resources.
10	Physical	Circumstances beyond anyone's control- natural disasters; wars, coups, acts of terrorism.	Lack of foreign investment or technology flow.

Table C.3. Hierarchy of Eight Location Factors.

Factor	Metrics
1. Market	Proximity to markets Local consumer's purchasing power
2. Transportation	Land transportation Water transportation Air transportation
3. Labor	Availability of general employees Availability of engineering and science employees Labor unionization Work stoppages
4. Site consideration	Cost of land Cost of plant construction
5. Raw materials and services	Availability of raw materials Availability of business services
6. Utilities	Energy generating capacity Energy cost Fuel availability Water availability
7. Government concerns	Federal aid to local government Government's debt Taxes State supported employment training
8. Community environment	Housing availability Education Health and medical consideration Human services Security Environmental consideration Cost of living Business climate Physical climate

Source: Jungthirapanich and Benjamin (1995, p. 790)

Table C.4. Hard Location Factors. (Scherrer, 2002)

Location factors	Dimensions and indicators (examples)			
	Quantity	Quality	Cost/price	Risks
Local markets -labor market -Customer markets -Procurement -Business services -Subcontractors and partners -Education, R&D -Capital market and finance	Labor supply; Purchasing power; Market size; Universities and research institutes; graduates; Savings rate	Skill, flexibility; Market competition Firm size structure Experience of local Supplier; technical and business graduates; Market liquidity	Labor cost; Cost of market Entrance and leaving the market	Risk of labor unrest Rule of law, Market risks
Infrastructure -Waterways, roads, train, airplane -Public and private transport -Mail -Telecom -Energy, water -Waste, waste water	Km of transport routes; number of connections; Person- freight; Availability Availability, capacity	Attainability by client and subcontractors; Speed, of service, transfer times, technical standard; Energy sources; water quality; disposal of specific sorts of waste; distance to waste disposal sites	User fees. Gas price, Train and air fares, Telecom fares, other prices	Reliability of service: Strike rates, breakdowns, environmental risk
Land as input factor -For production sites -Living -Raw materials	Availability, access, system of property rights	Availability of infrastructure, traffic connections	Price of land/real estate, cost of constructi on; cost of access to raw materials	Property rights and law enforcement
Geographic position -Economic integration -Interregional and international market relations	Foreign trade Regional specialization	Market access, proximity		Political and legal risks
Public finances -Taxation -Subsidies		Complexity of the system, bureaucracy	Tax rates and structure Amount of subsidies	Predictability of (tax) policy

Table C.5. Soft Location Factors. (Scherrer, 2002)

Location factors Items	Indicators (examples)
Politics and stability of the society -Political stability -Economic policy -Social stability	Predictability of political decisions Regulatory activity Strikes, labor relations
Administrative and legal system -Reliability -Speed -Customer oriented	Rule of law; protection of property rights Time required for received permits Structure of the public administration system
Work attitudes of the local population -Entrepreneurship -Open mindedness	New firm creation Interregional differences in referendum results, share of foreigners in the local population
Quality of life -Natural environment -Cultural environment and facilities -Sports possibilities	Imission data, climate Quality and variety Availability and proximity

Table C.6. Factors Influencing Land-use Change. Prieler et al., (1998)

No.	Factors
1	Former land-use structure and change
2	General economic environment, GDP share (agriculture, forestry, industry, other), Share in employment (agriculture, forestry, industry, other), International market developments (esp. in agriculture and forestry).
3	Agriculture and forestry, Percentages of GDP and of employment in agriculture/forestry, Production structure, Size of farms/forests, Ownership structure, Policies (subsidies, taxes, agricultural pricing policies, special short-term measures, incentives for afforestation, environmental incentives, etc.) Forestry/farmland use (commodity production, recreation, protected areas)
4	Environmental conditions, Climate, topography, soil characteristics, water availability ,Environmental pollution (acidification or other pollution load)
5	Social context, Demographic factors (population density, migration, etc.), Markets for agricultural and forestry products (local and international), Traditional land use, Attitudes and values (toward the landscape, cultural heritage, and nature conservation)
6	Policies related to land-use planning, Development plans, Legal frameworks (land-use planning, land-use policy)

Table C.7. Land Valuation Factors Which May Affect a Land Parcel Value. (Yomralioglu and Parker, 1993)

Code	Valuation Factors
1	Supplied basic services
2	Permitted number of floors
3	Landscape view
4	Access to street
5	Parcel location within block
6	Permitted construction area
7	Environment
8	Street frontage
9	Land parcel shape
10	Distance to city center
11	Currently usable area
12	Distance from nuisance
13	Distance to educational centers
14	Access to highway
15	Soil condition
16	Distance to shopping centers
17	Distance from noise
18	Distance to health services
19	Distance to recreational areas
20	Topography
21	Distance to religious places
22	Available utilities
23	Distance to play garden
24	Distance to car parking area
25	Access to waterway
26	Access to railway
27	Distance to fire station
28	Distance to police station

Table C.8. International Risk Factors (Bhutta, 2004)

Factors	Comments
Market factors Customers and competition Power and prestige	Elements dealing with size and growth or markets, Product mix and distribution issues, Brand name protection and Competitive issues
Production/Manufacturing Low cost producers Exploitation of research and development Economies of scale and scope Synergy issues	Most important operational issues that need to be considered. Deciding on the number of facilities to operate, capacity of the respective facilities, operating efficiencies at each facility, raw material, and labor availability, working capital and initial investment required are some of the important decisions to be made. Companies adopt various strategies to compete under different conditions. These strategies include being a low cost producer, exploiting research and development, and synergy, among others.
Economic risk/Government policy Reactive and proactive participation Government incentives Taxes Trade regulations	Global economy means exposing oneself to the risks associated with international trade. Most of these risks stem from political and economical stability issues in the host country. Some of the factors that need to be considered in addition to these are exchange rates, tariff, inflation rates, and so on.

Table C.9. The Importance of Location Factors to Location Decision Making. Yang (2004)

Sub variables	Indicators
1. Proximity	- to CBD - to clients - to suppliers - to similar firms - to intellectual property owners - to joint venture partner - to venture capital provider
2.Business operating cost	- Business premise - Labor - Transportation
3. Infrastructure	- Business premise - Transportation - Telecommunication - Complementary business services - Finance
4. Employment	- Availability of highly skilled staff - Ability to retain staff - Ability to attract skilled staff - Unionization - Industrial relation issues
5. Amenities	- Life style - Ability to cater business clients from outside of Brisbane - Cost of living
6.Other variables	- Area for business expansion - Link with local and regional industries - Proximity to clients - Business premise accessibility - Link with research institutions - Government policy and support

Table C.10. List of Location Factors. (Sergot, 2003)

No.	Location factors
1	Quality of the local road network
2	Rapid availability of suitable premises
3	Proximity to important customer(s)
4	Availability of suitable premises
5	Cost of land and/or premises
6	Proximity to market
7	Will to reduce employees' travel time to work
8	Availability of skilled labor
9	Quality of the relationships with local government(s)
10	Quality of the local communication network
11	Level of local taxes
12	Availability of suitable buildings sites
13	Quality of life for employees
14	Accessibility of the location by public transport
15	Quality of local climate and environment
16	Incentives given by local government(s)
17	Local origin of manager(s) of the firm
18	Local cost of labor
19	Proximity to the firm's headquarters
20	Possibility to hire skilled labor from other local firms
21	Proximity to supplier(s)
22	Prestige/Visibility of the location
23	Proximity to other establishment(s) of the firm or the group
24	Proximity to a national airport
25	Local network of social ties of manager(s)
26	Proximity to an international airport
27	Local presence of business services
28	Proximity to railroad facilities
29	Availability of semi or unskilled labor
30	Proximity to higher education facilities
31	Prior local presence of similar establishments
32	Personal contacts of manager(s) in the business local milieu
33	Proximity to recreational and/or cultural amenities
34	Local job opportunities for employees' spouses
35	Personal contacts of manager(s) in the administrative and/or politic local milieu
36	Prior local presence of competitors
37	Premises provided by a commercial partner
38	Local presence of a banking decision center
39	Proximity to research facilities
40	Proximity to sources of raw material(s)
41	Proximity to a sea or river port
42	Location in a tax-free zone
43	Financial capital provided by a local venture-capital firm

Table C.11. Summary of Major Criteria and Sub-factors Affecting International Location Decisions (MacCarthy and Atthirawong 2003).

No.	Major factors	Sub-factors
1	Costs	Fixed costs; transportation costs; wage rates and trends in wages; energy costs; other manufacturing costs; land cost; construction/leasing costs and other factors (e.g. R&D costs, transaction and management costs etc.
2	Labor characteristics	Quality of labour force; availability of labour force; unemployment rate; labour unions; attitudes towards work and labour turnover; motivation of workers and work force management.
3	Infrastructure	Existence of modes of transportation (airports, railroads, roads and sea ports); quality and reliability of modes of transportation; quality and reliability of utilities (e.g. water supply, waste treatment, power supply, etc.) and telecommunication systems
4	Proximity to suppliers	Quality of suppliers; alternative suppliers; competition for suppliers; nature of supply process (reliability of the system) and speed and responsiveness of suppliers
5	Proximity to markets/customers	Proximity to demand; size of market that can be served/potential customer expenditure; responsiveness and delivery time to markets; population trends and nature and variance of demand
6	Proximity to parent company's facilities	Close to parent company
7	Proximity to competition	Location of competitors
8	Quality of life	Quality of environment; community attitudes towards business and industry; climate, schools, churches, hospitals, recreational opportunities (for staff and children); education system; crime rate and standard of living
9	Legal and regulatory framework	Compensation laws; insurance laws; environmental regulations; industrial relations laws; legal system; bureaucratic red tape; requirements for setting up local corporations; regulations concerning joint ventures and mergers and regulations on transfer of earnings out of country rate
10	Economic factors	Tax structure and tax incentives; financial incentives; custom duties; tariffs; inflation; strength of currency against US dollar; business climate; country's debt; interest rates/exchange controls and GDP/GNP growth, income per capita
11	Government and political factors	Record of government stability; government structure; consistency of government policy; and attitude of government to inward investment
12	Social and cultural factors	Different norms and customs; culture; language and customer characteristics
13	Characteristics of a specific location	Availability of space for future expansion; attitude of local community to a location; physical conditions (e.g. weather, close to other businesses, parking, appearance, accessibility by customers etc.); proximity to raw materials/resources; quality of raw materials/resources and location of suppliers

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