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RELATIONAL ANALYSIS BETWEEN THE INDICES FOR PRODUCTION STAGE IN AN INTERNATIONAL LOGISTICS SYSTEM DEVELOPED BY AIRPORTS AND NATIONAL RESOURCES FACTORS

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Abstract: Due to the development of global industries, many corporations view global market place as a single market. For the purpose of centralizing goods, many international manufacturers have warehoused large amounts of basic semi-products in a few strategic logistical locations. Thus, the problem of location competition has resulted. For the differences of international transportation, industry, and economic environment among airports, the logistical development of airports have various stages and modes, involving various location factors. Therefore, airports should be equipped with suitable (competitive) logistics location. Thus, according to the suitable development type to strengthen the competitive conditions is an important issue for strengthening competitive advantages. From the perspective of national resources, proposing fuzzy quality function deployment (FQFD) to construct relational matrix of competitive indices and national resources factors, based on Porter's Diamond Theory. Finally, analyze priority ranking of national resources and contribution ranking of the overall national resource to each competitive index.

Key Words: National resources, International logistics system, Fuzzy quality function deployment (FQFD), Diamond Theory

1. INTRODUCTION

Recently, the life cycles of products (e.g. CPUs) produced by global industries are becoming shorter; the prices of products have dramatically slumped; the transportation of goods is faster; messages can be instantly delivered to any place of the world; and the production mode has been modified to meet customer needs. All these transformations have led to a tendency among industries to expedite the transportation of goods, shorten product life cycles, accelerate the development process of products, diversify the range of merchandise, and

prolong both the cycle time of production and the lead time for primary products. Thus, many corporations now view the global market as a single market, establishing production bases in various regions, purchasing raw materials from suppliers of different countries, and distributing the products all over the world. The procurement, division of labor for production, and marketing on a global basis always involves trans-national circulation of goods, so the demand for international logistics is soaring. To centralizing goods, many international manufacturers warehouse large amounts of basic semi-products in a few logistically strategic locations in order to proceed with the high value-added distribution service. As a result, distribution centers have been established at or near airports to enhance the economic activities of the region and gain the value-added of the airports. Thus, the problem of location competition has resulted.

Due to the differences of international transportation, industry, and economic environment among airports, the logistics development of airports have various stages and modes, involving various location factors. Therefore, airports should be equipped with suitable (competitive) logistics functions. Thus, investing national resources according to the suitable development type to strengthen the competitive conditions for the airports in the development process is an important issue for strengthening competitive advantages. From the perspective of national resources, due to limitations on the resources and urgency of the policy implementation, international logistics systems developed by airports should consider the efficacy of the national resources invested.

This paper introduces the two stages (transportation stage and production stage) and four modes (import/export, transshipment, re-import processing, and re-export processing modes) for an international logistics system from a value-add perspective. Then, fuzzy quality function deployment (FQFD) is used to construct the relationship between the Porter's Diamond Theory of national resources factors and the competitive indices of production value-added stage (re-processing import and re-processing export modes) of an international logistics system developed by airports. The analysis results could be utilized to evaluate the priority of national resources factors and the overall national resources contribution to the development of international logistics system, and to propose competitive strategies for the airports.

2. TWO-STAGE (FOUR MODES) OF INTERNATIONAL LOGISTICS SYSTEM MODEL

2.1 The Characteristics of International Logistics

The term "international logistics" refers to the exchange of cargo between two or more countries. Like domestic distribution, international distribution can be divided into two major parts, physical supply and physical distribution. The former refers to the process of providing cargo from the raw materials industries to the manufacturing industries. The latter refers to the process in which the manufacturing industry delivers the finished product into the hands of the consumer. In recent years, due to consumer's varied and rapidly changing needs, "low volume", "high frequency" and other diverse modes of delivery services have become necessary. As a result the actual process of dispersing cargo has become one of the major challenges faced in the development of the international distribution of cargo. The characteristics of international logistics are including: (1) The International raw materials market, semi-finished products and commodities; (2) Harbor conditions; (3) Local

manufacturing; (4) International consumer market; (5) Local consumer markets.

2.2 The Modes of International Logistics Activity

According to relevant references, competitiveness can be measured by the creation of value (Porter, 1980, 1985, 1990). From this point of view, logistics systems may be viewed as value chain systems measured by the creation of a value. According to Toffler's third wave theory (1980) (agricultural era, industrial era, information era), and Hope (1997) "Competing in the 3rd Wave," production can be divided into three layered stages in the development of the three waves of increasing value: production capacity, prime cost, and the direction of value added. They believe that production capacity should pursue an increase in the value of cargo. Considering the above mention perspective, this paper analyzes the role of intensive labor, intensive technology and intensive services in purchasing, shipping, storage, production, fabrication, examination, selling, information and research of international cargo, thereby establishing a value chain system. This has two integrated stages (four mode)(Lin et al., 2005): transportation value-added (import/export and transshipment mode), production value-added (re-processing import and re-processing export mode). Due to limitations of space, this paper was conducted only to discuss production value-added stage of international logistics system.

3. RELATIONAL MODEL BETWEEN COMPETITIVE INDICES FOR PRODUCTION VALUE-ADDED STAGE AND NATIONAL RESOURCES

3.1 Competitive Indices for the International Logistics System in Airports

In this paper, the competitive indices of production value-added (re-processing import and re-processing export mode) developed by Liang et al. (2003) and Lin et al. (2005) (Table 1) were used as the competitive indices for the international logistics system in the airports.

Table 1. Competitive Indices for the Re-processing Import and Re-processing Export Mode

Re-processing import mode		Re-processing export mod	
Dimension	index	Dimension	index
Domestic market location	Domestic consumption market	International market location	International consumption market
	Domestic manufacturing market		International manufacturing market
Outside of transportation system	Outside conveyance of transportation system	National stability	Political stability
	Outside hustle of transportation system		Economic stability
Airport operation and management	Air terminal fee rate		Social stability
	Tax rate	Airport operation and management	Air terminal fee rate
	Clearance efficiency		Tax rate
	Management Information		Clearance efficiency
Re-Proc. Support	Information ability		Management Information
	Humanity quality		Information-processing ability
	Industry cluster ability	Economical scale	I/E volume
	Cost of acquiring facilities		Transship volume
		Re-Proc. Support	Humanity quality
			Hi-tech industries' supports intensity
			Industry cluster ability
			Wage level
			Add-valued tax rate

3.2 Analysis for National Resources Factors

(1) Resources are the primary source of a nation's competitive advantages
Wernerfelt (1984), "Resource-Based View (RBV) Theory", stated that "resource" and "product" are actually two sides of the same coin. To complete the production of most products, the organization of resources is required. If such organization can form resource position barriers, it will bring in high profits. Grant (1991) claimed that "resources" and "capabilities" were the groundwork for pursuing profits by each company, and an enterprise could make large amounts of profits was determined by two factors: The attractiveness of its products and the establishment of its competitive advantages. However, related research has indicated that there is no significant relation between industrial structure and profitability. Thus, competitive advantages are the only significant factor that contributes to an enterprise's earning of profits. Furthermore, both the formation of competitive advantages and the industrial attractiveness are grounded on "resources."

According to Prahalad & Hamel (1990), the rules for competition among enterprises have changed. Different levels of competition involve different kinds of "stakes." As far as the strategy of long-term management is concerned, a company needs to outperform its rivals in the three closely related aspects of core competency, core products and final products, in order to establish and maintain its leading position in the industry. Although short term a company is competitive advantages originate from final products, in the long run to sustain or lose strong competitiveness still has much to do with the company's core competency. Therefore, this study suggests that companies transfer their strategic business focus from final products to their core competencies and examine to the source of competitive advantages. According to Hall (1992), a manufacturer can sustain competitive advantages due to differences between its capabilities and those of its competitors. The capabilities of a manufacturer are rooted in its intangible assets, and different assets result in different capabilities**.**

Some scholars, by taking the manufacturers' view of the business world, have tried to explore the reasons for the contribution of resources to the formation of competitive advantages. Mahoney & Pandian (1992) claimed that manufacturers' activities displayed a series of progressing movements. Therefore, manufacturers could utilize the features of such a progression to choose to combine or separate different resources in order to create sustaining competitive advantages. Amit & Schoemaker (1993), however, considered the behavior aspect and stated that each manufacturer had a "bounded rational" supervisor who when faced with high uncertainty, a complicated environment and internal conflicts would use different strategic assets. Therefore, they concluded that different industries, different resources obtained and different bounded rationality and behavior of supervisors in decision-making all contribute to a manufacturer's maintenance of competitive advantages. Porter (1991) claimed that an enterprise's competitive advantages were from valuable resources owned by its manufacturer(s). These resources, unlike others, were immobile and therefore could be possessed by an enterprise. Hall (1992) asserted that the sustainability of competitive advantages was affected by certain external factors, mainly due to the difference among enterprises in the properties of resources shaped by the environments in which those enterprises are situated, as well as in their capabilities.

Based on this analysis, any company or manufacturer must make the best use of its core resources and external environment in order to obtain competitive advantages. Hence, when a researcher conducts an analysis of the competitive advantages of an international logistics system, external factors such as the input of national resources should be taken into account.

For a country to develop a successful international logistics system, it is to sustain its competitive advantages by making the best use of domestic resources as well as its geographic location to develop a suitable international logistics system. The logic analysis on the strategy of national resources input is illustrated in Figure 1.

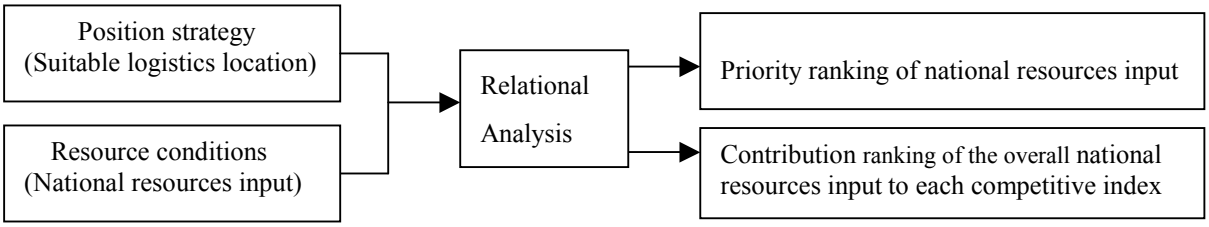

Figure1. The Logic Analysis on the Strategy of National Resources Input of the International Logistics System

(2) The view of national resources from the Diamond Theory

This discussion is the view of the national competitiveness, based on the input of national resources input. Porter's Diamond Theory was utilized to evaluate the national resources input according to the possible factors that affect national competitiveness. In his research of a nation's competitive advantages, Porter (1990) determined competitive advantages by adopting the concept of "value-chain." Ten important trading companies were covered in his study where four environmental factors that impact the international competitive advantages were mentioned. To explain why one nation could be more successful than others with its certain industries in international market, Porter established a diamond-shaped competitive mode, known as the Diamond Theory. The environment shaped by the nation itself may increase or impede the competitiveness among different industries. As a result, industrial clusters may be developed. A cluster of such kind could form disadvantages for other nations, yet it can create a value chain effect and consequently bring each advantages to industry within this cluster, which were defined as the "industry's international competitiveness."

Numerous extensions, modifications and revisions have spanned after the introduction of Porter's Model (e.g. Daly, 1992; Dorrenbacher & Wortmann, 1991; Dunning, 1991, 1992, 1993; Hodgetts, 1993; Narula, 1993; Pearce & Robinson, 1991; Rugman, 1991). Thus, Porter's model seems to be acceptable for many academic and practical uses. Considering the significance of this system, the Diamond Theory was selected to explain factors that generate sources for the nation's competitiveness. The diamond model is based on four country-specific "determinants" and two external variables. Porter's four determinants and two outside forces interact in the "diamond" of competitive advantage with the nature of national international competitiveness depending upon the type and quality of these interactions. In this paper include:

(1) Factor conditions: A) Human resources, B) Natural resources, C) Knowledge resources, D) Capital resources, E) Physical infrastructure.
(2) Demand conditions: A) The nature of the domestic market, B) Demand scale and growing speed, C) The ability to shift gears to meet international demands.
(3) Related and supporting industries: A) Fate-sharing within the network of interrelated businesses, B) The pull-through effect on related industries.
(4) Firm strategy, structure and rivalry: A) Cost reduction-driven strategy B) Capabilities of becoming internationalized, C) Set goals for future development, D) Competitiveness of rivals within industry.
(5) Chance: Creation of new advantageous situations

(6) Government: A) Government control, B) Laws and regulations.

With a focus on the aspect of national competitiveness and based on resource theories, this paper utilizes the elements of the diamond theory to examine the domestic resources input that changes the competitive indices of the international logistics system. In addition, by integrating the concept of the competitive indices of a location with the national resources input, the relation between the production value-added stage of international logistics system and the diamond theory is developed. The purpose of this paper is to ensure that the national resources will be efficiently used and to reduce their unnecessary waste.

According to this analysis, the competitive advantages of the international logistics system are closely related to the national resources input. Thus, in this paper the aspect of an airport's international logistics system and the nation's competitiveness are considered to construct a model for analysis of the relationship between the competitive indices of production value-added stage and national resources elements. By this model, the priority ranking for the national resources input and contribution ranking of the overall national resources can be input to each competitive index. The aim of this paper is to provide the reference for the production value-added stage of international logistics system developed and strength the competitive advantages by airports.

4. RESEARCH DESIGN AND METHODOLOGY

4.1 Questionnaire Design and Data Collect

Here we define the relationship between the competitive indices of the international logistics system and the national resources input, as well as for contribution ranking of the overall national resources input to each competitive index. The questionnaire method was used, and interviews were based on the research needs and survey principles (Table 2). 30 copies of questionnaire were distributed, among which 18 were collected (8 from the logistics industry, 6 from governmental officials and 4 from scholars) and all 18 were considered valid. The return rate of questionnaires was 60%.

4.2 Research Methodology

This section introduces the research methods adopted to facilitate this paper.

(1) Quality Function Deployment (QFD)
A. The Concept of Quality Function Deployment (QFD)
After the concept of QFD first emerges in Japan in 1970, it rapidly spread to others countries and different industries. QFD is generally processed according to practice and experience, so it has not been theoretically systematized. Therefore, many experts have made their own definitions of QFD. According to Akao (1991), the spokesman for Japan's QFD concept, QFD in its broad sense is a general term for QD (Quality Deployment) and QFD in its narrower sense. Bossert (1991) claimed that QFD provided a structural method to assist an enterprise in evaluating customer demands and consequently establishing its managerial system. Sullivan (1986) asserted that QFD is an overall concept, meant that during the process of developing and manufacturing for product, customer needs could be transferred into adequate demands for techniques. Conti (1989) stated that QFD was the optimal method for planning the overall

Table 2. Questionnaire Design and Survey Principles

Principles	Description
Questionnaire purpose and measure criteria	Introduce the purpose of questionnaire and descript the based theory for the relation between the competitive indices of two-stage (four modes) logistics system and the national resources factors input, and measure criteria.
The measure basis for relational value	With the relational matrix evaluation for each mode, we start by listing the factors and their relation value on a scale 1 to 5 (The higher score the more related they are to each other).
Survey Scale	In Taiwan
Questionnaire Sample	Logistics executive, Governmental officials from Ministry of Economic Affairs Industry Bureau; Export Processing Zone; Ministry of Transportation & Communications parties concerned (port authorities), and experts.
According to various stages and modes separate consideration	Due to the differences types for international logistics, involving various location factors. Thus, questionnaire survey for the relationship between the competitive indices of two-stage (four modes) and the national resources factors must be separated to evaluate.

procedure of production and for satisfying customer needs.

B. Procedure of QFD

According to Akao (1991), QFD provides a set of systematic techniques, which can transform customer demands into quality standards for the design of products or service. Akao asserted that the most important concept in House of Quality (Japanese style) was that a matrix could be used to facilitate the transformation of quality. Five steps are involved in constructing House of Quality, as shown in Figure 2.

(2) Fuzzy set theory

In a universe of discourse of *X*, a fuzzy subset *A* of *X* is characterized by a membership function f_A, which maps each element *x* in *X* to a real number in the interval $[0,1]$. The function value represents the grade of membership of *x* in *A*. A fuzzy number *A* (Dubois & Prade, 1978; Laarhoven, 1983) in $\Re$ (real line) is a triangular fuzzy number if its membership function $f_A : \Re \to [0,1]$ is

$$f_A(x) = \begin{cases} \dfrac{x-c}{a-c} & , \quad c \le x \le a \\ \dfrac{d-x}{d-a} & , \quad a \le x \le d \\ 0 & , \quad otherwise \end{cases} \tag{1}$$

With $-\infty < c \le a \le d < \infty$, the triangular fuzzy number *A* can be represented by (*c*, *a*, *d*). By the extension principle (Zadeh,1965) the extended algebraic operations of any two triangular fuzzy numbers $A_1 = (c_1, a_1, d_1)$, $A_2 = (c_2, a_2, d_2)$ can be expressed as:

$$A_1 \oplus A_2 = (c_1 + c_2, a_1 + a_2, d_1 + d_2); \quad K \otimes A_1 = (kc_1, ka_1, kd_1), k \in R, \quad k \ge 0.$$

(3) Superiority ratings of triangular fuzzy numbers

To effectively and easily represent the superiority ratings of all alternatives under each criterion above the alternative level and the aggregation superiority ratings of all alternatives, the graded mean integration representation method (Chen & Hsieh, 1999) is used to determine the representation value of superiority ratings characterized by triangular fuzzy number. That is, if *A*=(*c*, *a*, *d*) denotes the fuzzy superiority ratings, then the graded mean integration

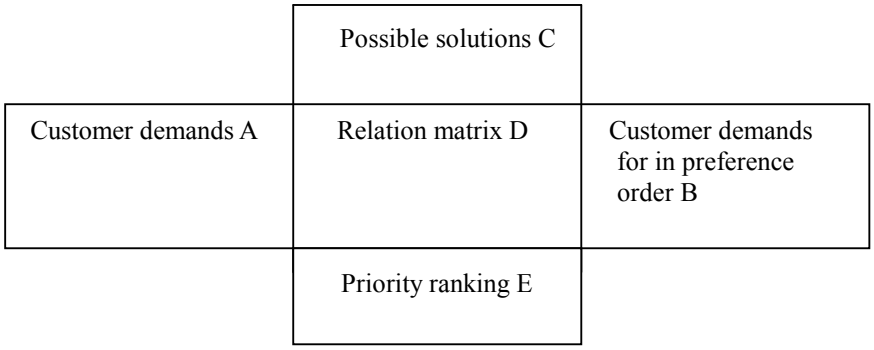

Figure 2. House of Quality (Japanese Style)

representation value of R (A) can be expressed as:

$$R(A) = \frac{c + 4a + d}{6} \tag{2}$$

(4) Measure for the relation matrix of relevant value

The concept of linguistic variable (Dubois & Prade; 1978; Yager, 1978; Zadeh, 1976) is useful in describing situations that are complex or poorly defined by quantitative expressions. Linguistic value can be represented by the approximate reasoning of fuzzy set theory. Define the linguistic relation values set S= $\{\mathrm{HR}, \mathrm{MR}, \mathrm{LR}, \mathrm{IR}\}$, where HR=High Relevant, MR=Medium Relevant, LR=Low Relevant, and IR=Irrelevant. Here, the linguistic values in S sets are used by the decision-makers to evaluate the suitability of alternative versus various criteria above the alternative level. The membership function of each linguistic value is defined as: HR=(0.5,0.75,1), MR=(0.25,0.5,0.75), LR=(0,0.25,0.5), IR=(0,0,0).

5. RELATIONAL MATRIX OF COMPETITIVE INDICES FOR THE PRODUCTION VALUED-ADDED STAGE AND NATIONAL RESOURCES FACTORS

In this paper, Fuzzy quality function deployment (FQFD) is used to establish a matrix that displays the relation between the competitive indices of production value-added international logistics system and resources factors. Exact evaluations were conducted to determine the priority ranking of resources factors input and to further analyze the contribution ranking of the overall resource input to each competitive index international of logistics system. The exact steps are shown below:

Step1: Establish the framework of relational matrix.

Step2: Use the AHP method to acquire the normalized weight value of the location competitiveness indices of the logistics system

Step3: A relation value can be obtained by evaluating the degree of relation between the competitive indices and national resources factors

Step4: Convert each relation value into a triangular fuzzy number and use the arithmetic average method to obtain the agreement from experts and then a relational matrix can be established

Step5: By adding all the weighted values of the resources factors, the weight of each factor of the national resources factor will be obtained.

Step6: Utilize the fuzzy ranking formula (2) to obtain the value of each factor and element of the national resources. By ranking, the national resources of factors and elements input can be sorted out in priority ranking

Step7: By applying the horizontal summation to the competitive indices of the international logistics system, the different degrees of contribution and ranking made by the overall national resource input to each of the competitive indices of the international logistics system can be obtained.

5.1 Establishing the Structure of the Relational Matrix

The framework of the relational matrix for the competitive indices of the international logistics system and resource factors is illustrated in Figure 3. The relational matrix is composed of dimension, competitive index of the international logistics system and the resource factors, elements. This relational matrix can be processed with QFD to obtain relational matrix of the production value-added stage.

5.2 Normalized Weight Value of the Competitive Indices of the Production Value-Added International Logistics System

In this section, the research results Liang et al. (2003) and Lin et al. (2005) of the production value-added were further utilized to obtain the standardized weighing of competitive indices of re-processing import and re-processing export mode, as illustrated in Table3.

5.3 The House of Quality Relational Matrix for the Competitive Indices and the National Resources Factors

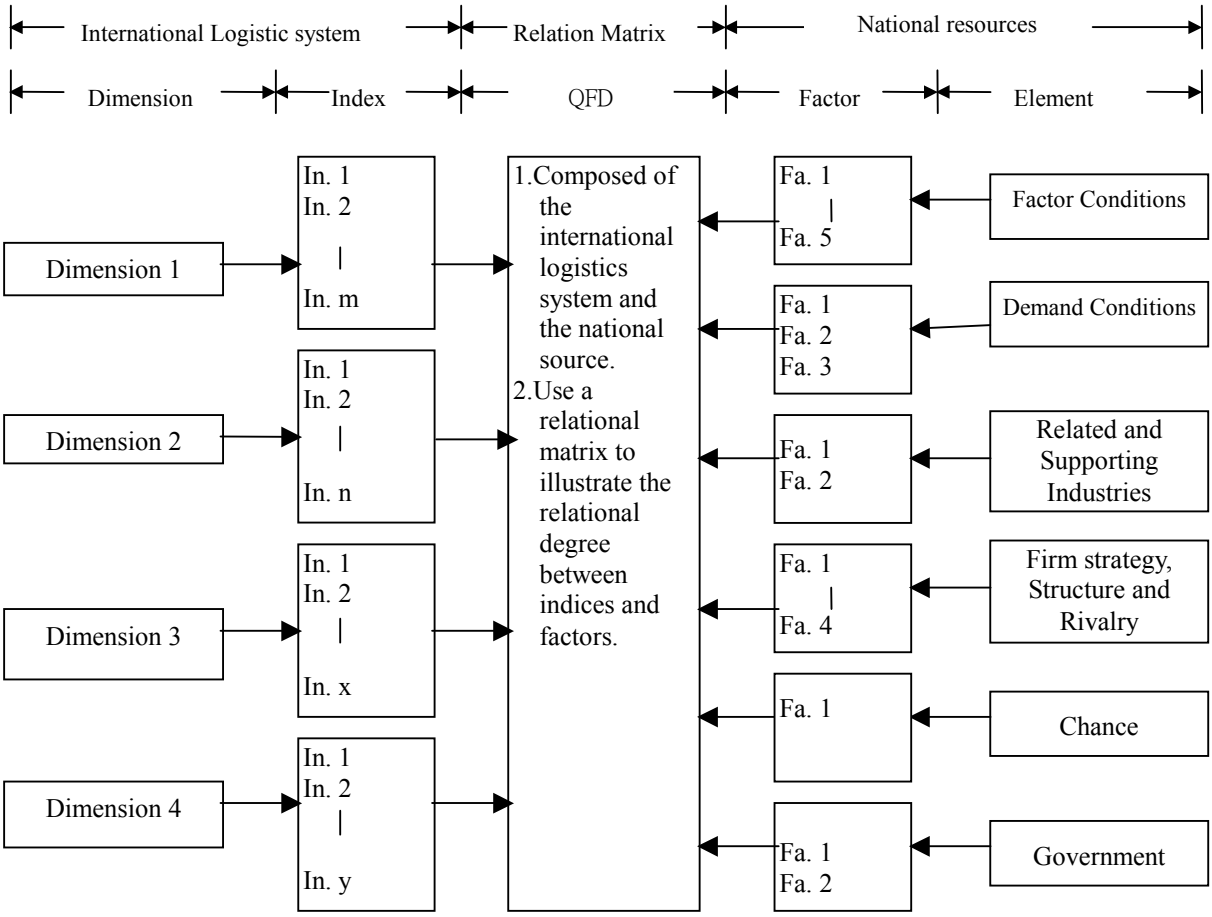

Figure 3. The Relational Matrix for the Competitive Indices and Factors

In this section, to obtain the weight value of national resources factors, the averaging method is used on a number-by-number basis to sum up the weighted values derived from the normalized weight value of the competitive indices of the production value-added international logistics system (Table 3) and the evaluation result of the relational matrix. By using the triangular fuzzy ranking formula (Formula (2)), the priority ranking of resources factors can be determined. Then process the competitive indices of the international logistics system using the horizontal summation method to measure the contribution degree made by the overall national resources input and then to process ranking. The result illustrated in Tables 4 through 6.

5.4 Relational Analysis on the Competitive Indices in Development of Production Value-Added Stage by the Airports and National Resources Factors

A. Analysis of the importance degree for developing the competitive indices by the airport

An airport develops its suitable location according to its own conditions. Services provided by the re-processing import mode differ from the re-processing export mode. The difference is that non-key techniques are used in the re-processing import mode, where semi-finished goods that are imported from foreign countries are combined with components developed by the core techniques of the country and then assembled for domestic distribution. The re-processing export mode, in addition to the basic loading and unloading of goods together with, transshipment and combination of containers of goods, also involves the delivery and storage of goods, information processing, logistics and processing, etc. Industries of such mode in the logistics system can function to create high added-value logistical services and can make significant contributions by keeping the domestic industries from relocating to other countries. For that reason, the re-processing import mode has different emphases from the re-processing export mode on competitive indices. More details are given below.

A.1. Re-processing import mode

When an airport develops re-processing import mode within an international logistical system, the following five competitive indices will receive priority of importance (Table 3): 1) wage level, 2) cost of acquiring facilities, 3) humanity quality, 4) industry cluster ability, and 5) air terminal fee rate. Among these, “wage level,” “cost of acquiring facilities” and “Air terminal fee rate” can influence the production cost, which as a result will affect the logistics companies’ desire to add value to the industry. “Humanity quality” and “ability to cluster industries” have an impact on the quality of the investment environment. It can be seen that the interviewees considered that the cost of the industries near the airport and the quality of the investment environment could have crucial effect for the airport to develop re-processing import mode in an international logistics system.

A.2. Re-processing export mode

When an airport develops re-processing export mode of international logistical system, the following five competitive indices will receive priority of importance (Table 3): 1) transship volume, 2) hi-tech industries’ supports intensity, 3) I/E volume, 4) ability to cluster industries, and 5) humanity quality. Among these, “transship volume” and “I/E volume” affect on the handling cost of unit goods. Among these, “Hi-tech industries’ supports intensity” and “Humanity quality” affect on the value-added ability. The higher the value-added ability an industry has, the more value-addition it can obtain. Therefore, the industry can shape the added-value quality. “Ability to cluster industries” influences production cost, time and flexibility. This finding shows that interviewees considered that factors, such as the cost of handling unit goods, added-value quality, time and flexibility, could mold crucial conditions for the airport to develop re-processing export mode in an international logistics system.

Table 3. Normalized Weight Value of Competitive Indices of the Production Added-Value Stage

Re-processing import mode			Re-processing export mode		
Dimension	Index	Weight Value	Dimension	Index	Weight Value
Domestic market location	Domestic consumption market	0.0172	International market location	International consumption market	0.0062
	Domestic manufacturing market	0.0145		International manufacturing market	0.0220
Outside of transportation system	Outside conveyance of transportation system	0.0129	National stability	Political stability	0.0186
	Outside hustle of transportation system	0.0106		Economic stability	0.0443
Airport operation and management	Air terminal fee rate	0.0269		Social stability	0.0236
	Tax rate	0.0094	Airport operation and management	Air terminal fee rate	0.0075
	Clearance efficiency	0.0188		Tax rate	0.0072
	Management Information	0.0103		Clearance efficiency	0.0111
Re-Proc. Support	Information ability	0.1570		Management Information	0.0139
	Humanity quality	0.0841		Information-processing ability	0.0123
	Industry cluster ability	0.2668	Economical scale	I/E volume	0.1005
	Cost of acquiring facilities	0.3714		Transship volume	0.2479
			Re-Proc. Support	Humanity quality	0.0796
				Hi-tech industries' support intensity	0.1671
				Industry cluster ability	0.0992
				Wage level	0.0690
				Add-valued tax rate	0.0701

B. Analyzing the priority ranking of the national resources factors input

Considering an airport's effect on the priority ranking of the resources input in the re-processing import mode and re-processing export mode when it develops its production value-added international logistics system, this section provides detailed explanation.

B.1. R e-processing import mode:

As shown in Table 4, when an airport develops the re-processing import mode in an international logistics system, nine key factors are uses to determine the priority ranking of the national resources input. They are listed as follows in descending order: 1) drivers of production cost, 2) government control, 3) laws and regulations, 4) human resources, 5) competitiveness of the business rivals in the same industry, 6) knowledge resources, 7) creation of new advantageous situations, 8) "fate-sharing" within the network of interrelated businesses, 9) physical infrastructure. Among these, three key factors of Factor conditions, i.e. "human resources," "knowledge resources" and "physical infrastructure," together accounted for 29.48% in the evaluation of the priority value of the national resources input. In the Firm strategy, Structure and Rivalry, there are two key factors: "drivers of production cost" and "the competitiveness of the business rivals in the same industry," which together accounted for 26.80% in the evaluation of the priority value of the resources input. The resource element of "Government" is determined by two key factors: "government control" and "laws and regulations," which together accounted for 26.03% in the evaluation of the priority value of the national resources input. For the element of "Chance", the key factor, "creation of new advantageous situations," accounted for 9.69% in the evaluation of the priority value of the national resources input. In the element of "Related and supporting industries, only "fate-sharing" within the network of interrelated business" is included, which accounted for 8.0% in the evaluation of the priority value of the national resources input. The percentage of the priority execution ranking for integrating resources key factors represents the degree of

Table 4. Ranking for the key national resources factors input (Re-processing import mode)

National resources key elements	**National resources key factors**	**Relation value**	**Priority ranking**	**The percentage of the priority execution ranking for integrating key factors**
Factor conditions	Human resources	0.40500	4	29.48% (0.99289/3.36751)
	Knowledge resources	0.34461	6	
	Physical infrastructure	0.24328	9	
Firm strategy, structure and rivalry	Cost reduction-driven strategy	0.50006	1	26.80%
	Competitiveness of rivals within industry	0.40230	5	
Government	Government control	0.45039	2	26.03%
	Laws and regulations	0.42619	3	
Chance	Creation of new advantageous situations	0.32640	7	9.69%
Related and supportin industries	Fate-sharing" within the network of interrelated businesses	0.26928	8	8.00%
Total		3.36751		100%

relations between national resources input and the re-processing import mode of the international logistics system. It appears that a higher percentage indicates that they are more related to each other, and vice versa. According to the survey, interviewees considered that three key factors, including "Factor conditions," "Firm strategy, Structure and Rivalry," and "Government", were the major key elements among the national resources for an airport to develop the re-processing import mode of an international logistics system.

B.2. Re-processing export mode:

As shown in Table 5, when an airport develops the re-processing export mode in an international logistics system, nine key factors are used to determine the priority ranking of the national resources input. They are listed as follows in descending order: 1) "fate-sharing" within the network of interrelated businesses, 2) capabilities of becoming internationalized, 3) the ability to shift gears to meet international demands, 4) human resources, 5) government control, 6) knowledge resources, 7) cost reduction-driven strategy, 8) laws and regulations, 9) demand scale and growing speed. In the Firm strategy, Structure and Rivalry, there are two key factors, i.e. "capabilities of becoming internationalized" and "cost reduction-driven strategy" together accounted for 23.12% in the evaluation of the priority value of the resources input. In the Factor conditions, there are two key factors: "human resources" and "knowledge resources," which together accounted for 21.83% in the evaluation of the priority value of the resources input. In the Demand conditions, there are two key factors: "the ability to shift gears to meet international demands and "Demand scale and growing speed"," which together accounted for 21.25% in the evaluation of the priority value of the resources input. The resource element of "Government" is determined by two key factors: "government control" and "laws and regulations." Which together accounted for 20.01% in the evaluation of the priority value of the resources input. In the element of "Related and supporting industries, "only "fate-sharing within the network of interrelated business" is included and which accounted for 13.79% in the evaluation of the priority value of the resources input. According to the survey, interviewees considered that three key factors, including "Firm strategy, Structure and Rivalry," "Factor conditions," and "Demand conditions", were the major key elements among the resources for an airport to develop the re-processing import mode of an international logistics system.

C. Analyzing the degree of contribution for overall national resource input to different indices

For this, use the horizontal summation method to analyze the degree of contribution made by

Table 5. Ranking for the National Resources Key Factors Input (Re-processing Export Mode)

National resources key elements	**National resources key factors**	**Relation value**	**Priority ranking**	**The percentage of the priority execution ranking for integrating key factors**
Firm strategy, structure and rivalry	Cost reduction-driven strategy	0.30277	7	23.12% (0.71898/3011028)
	Capabilities of becoming internationalized	0.41621	2	
Factor conditions	Human resources	0.35895	4	21.83%
	Knowledge resources	0.32005	6	
Demand conditions	Demand scale and growing speed	0.25805	9	21.25%
	The ability to shift gears to mee international demands	0.40281	3	
Government	Government control	0.32495	5	20.01%
	Laws and regulations	0.29746	8	
Related and supporting industries	"Fate-sharing" within the network of interrelated businesses	0.42903	1	13.79%
Total		3.11028		100%

the national entire resources input to different competitive indices of the production value-added stage of international logistics system. With a larger contribution value, the overall resource input has greater impact on the competitive indices of this logistics system, and vice versa. More details about the degree of contribution made by different modes are addressed below, and the logistic competitive indices are analyzed according to different environments as well.

C.1. Re-processing import mode

As shown in Table 6, when an airport develops a re-processing import mode in an international logistics system, the contribution ranking of different factors that determine the national entire resources input are listed in descending order as follows: 1) domestic manufacturing market, 2) industry cluster ability, 3) domestic consumption market, 4) clearance efficiency, 5) humanity quality, 6) tax rate, 7) cost for acquiring facilities, 8) outside hustle of transportation system, 9) wage levels, 10) outside conveyance of transportation system, 11) air terminal fee rate, 12) management of information. The re-processing import mode involves the domestic industry-specific competition, i.e. the competition among domestic airports. Therefore, as far as the external logistic environment is concerned, the factors and their influence that contribute to an airport's ability to control the indices of its internal environment are listed in descending order as follows: clearance efficiency, air terminal fee rate, and management of information. The factors and their influence that impede an airport's ability to control the indices of its external environment include: domestic manufacturing market, industry cluster ability, domestic consumption market, humanity quality, tax rate, cost of acquiring facilities, outside hustle of transportation system, wage levels, and outside conveyance of transportation system. According to the survey, interviewees considered that after an airport inputs the nation's resources, of all the factors that influence the internal logistic environment, "clearance efficiency" the greatest impact on an airline company's production cost for its use of an airport. Of all the factors that impact the external logistics environment, however, "domestic manufacturing market" exerts the greatest influence on transportation cost and time; and second to them are the factors of "industry cluster ability" and "domestic consumption market." These factors can lead to vertical and horizontal integration among the airport's peripheral value-added up and down-stream industries, such as the establishment of free-trade areas. These effects will substantially affect

the logistics companies' desire to add value to the industry and to the transportation cost as well as time.

C.2. Re-processing export mode

As shown in Table 6, when an airport develops a re-processing import mode, the contribution ranking and values of different factors that determine the overall national resource input are listed in descending order as follows: 1) industry cluster ability, 2) hi-tech industries' supports intensity, 3) international consumption market, 4) international manufacturing market, 5) economic stability, 6) humanity quality, 7) social stability, 8) transship volume, 9) political stability, 10) management of information, 11) clearance efficiency, 12) I/E volume, 13) air terminal fees rate, 14) tax rate, 15) add-valued tax rate, 16) information-processing ability, 17) wage level. The re-processing export mode is one that involves international competition, i.e., competition among airports of different countries. Therefore, in terms of the internal and external logistics environment, factors and their influence that determine the indices of the internal environment within the domestic market are listed in descending order as follows: industry cluster ability, economic stability, humanity quality, social stability, political stability, management of information, clearance efficiency, I/E volume, air terminal fees rate, tax rate, add-valued tax rate, and information-processing ability. The factors and their influence that impede an airport's ability to control the indices of its external environment include: hi-tech industries' supports intensity, international consumption market, international manufacturing market, and transship volume. According to the survey, interviewees considered that among all the factors that impact the internal logistics environment after an airport inputs the nation's entire resources, "industry cluster ability" has the greatest influence on the logistic companies' desire to add value to the air industry, follower by "economic stability" and "humanity quality," which also greatly impact the airport management and support from other industries. As far as the external logistics environment is concerned, "hi-tech industries' supports intensity" has a dramatic impact on the value-added quality.

6. CONCLUSIONS AND SUGGESTIONS

6.1 Conclusions

In conclusion, this paper has proposed that an airport develops re-processing import mode will receive priority of importance: 1) wage level, 2) cost of acquiring facilities, 3) humanity quality; the priority ranking of the national resources input is: 1) drivers of production cost, 2) government control, 3) laws and regulations; and the contribution ranking of the national entire resources input is: 1) domestic manufacturing market, 2) industry cluster ability, 3) domestic consumption market. Develops re-processing import mode will receive priority of importance: 1) transship volume, 2) hi-tech industries' supports intensity, 3) I/E volume; the national resources input, "fate-sharing" within the network of interrelated businesses, capabilities of becoming internationalized, the ability to shift gears to meet international demands, are critical determinants affecting national resources input; and at the contribution ranking of different factors that determine the overall national resource input, industry cluster ability, hi-tech industries' supports intensity, international consumption market.

Global logistic strategies provided to the consideration for different logistic conditions shaped by the differences locations, industry properties, weighting factors related to various country dependent variables, and levels of economic development. Based on the mode in which an airport can be best developed, how to direct a nation's resources into this specific mode is an important issue that can determine the enhancement of an airport's competitive advantages.

Table 6. Contribution Ranking of the Overall National Resource Input to Each Competitive Index

Re-processing import mode				Re-processing export mode			
Dimension	**Index**	**Degree of Contribution**	**Contribution ranking**	**Dimension**	**Index**	**Degree of Contribution**	**Contribution ranking**
Domestic market location	Domestic consumption market	15.01278	3	International market location	International consumption market	16.16167	3
	Domestic manufacturing market	16.26833	1		International Manufacturing market	15.77833	4
Outside of transportation system	Outside conveyance of transportation system	12.06333	10	National stability	Political stability	11.72500	9
	Outside hustle of transportation system	12.97500	8		Economic stability	15.18500	5
Airport operation and management	Air terminal fee rate	12.05833	11		Social stability	12.50000	7
	Tax rate	13.73000	6	Airport operation and management	Air terminal fee rate	8.80333	13
	Clearance efficiency	14.50333	4		Tax rate	8.22500	14
	Management Information	0.62346	12		Clearance efficiency	11.07167	11
Re-Proc. Support	Humanity quality	14.30333	5		Management of Information	11.21500	10
	Industry cluster ability	15.76833	2		Information-processing ability	5.11111	16
	Cost of acquiring facilities	13.06833	7	Economical scale	I/E volume	10.71500	12
	Wage level	12.23833	9		Transship volume	12.47500	8
				Re-Proc. Support	Humanity quality	14.82833	6
					Hi-tech industries' supports intensity	20.73500	2
					Industry cluster ability	20.94000	1
					Wage level	2.67593	17
					Add-valued tax rate	7.47500	15

6.2 Suggestions

This paper explores the relationship between the competitive indices of production value-added stage logistics system and the national resources. Because development of the competitive strategies and follow-up evaluations are not discussed, this paper is expected to stimulate further opinions and research from all industries, governmental institutions and academia to probe into related issues.

REFERENCES

Akao, Y. (1991) **New Product Development-Applied Quality Function Deployment.** Productivity Press.

Amit, R. and Schoemaker, Paul J.H. (1993) Strategic Assets and Organizational Rent, **Strategic Management Journa**l, **Vol. 14**, 33-46.

Chen, S.H. and Hsieh, C.H. (1999) Graded Mean Integration Representation of Generalized Fuzzy Number, **Chinese Fuzzy Systems Association**, **Vol. 5**, 1-7.

Conti, T. (1989) Process Management and Quality Function Deployment, **Quality Progress**, Vol. 22, No. 12, 45-48.

Daly, D. (1992) Exchange Rates and Trade Flow: Recent Japanese Experience, **Business in the Contemporary World**, 86-100.

Dorrenbacher, C. and Wortmann, M.(1991) The Internationalization of Corporate Research

and Development, **Intereconomics**, **Vol. 25**, 139-144.
Dubois, D. and Prade, H. (1978) Operations on fuzzy number, **The International Journal of Systems Science**, 9, pp. 613-626, 1978.
Dunning, J.H. (1991) Dunning on Porter: Reshaping the Diamond of Competitive Advantage, **Business and Economic Studies on European Integration**, Copenhagen, WP, 6-91.
Dunning, J.H. (1992) The Competitive Advantages of Countries and the Activities of Transnational Corporations, **Transnational Corporations**, **Vol. 1**, 135-168.
Dunning, J.H. (1993) Internationalizing Porter's Diamond, **Management International Review**, **Vol. 33**, 7-15.
Grant, R.M. (1991) The Resource-Based Theory of Competitive Advantage: Implications for Strategy Formulation, **California Management Review**, **Vol. 33,** 114-135.
Hall, R. (1992) The Strategic Analysis of Intangible Resources, **Strategic Management Journal**, Vol. 13, 135-144.
Hodgetts, R.M.(1993) Porter's Diamond Framework in a Mexican Context, **Management International Review**, **Vol. 33**, 41-54.
Hope, T. (1997) **Competing in the** 3rd **Wave**.
Laarhoven, P.J.M.(1983) A fuzzy extension of Saaty's priority theory, **Fuzzy sets and Systems**, **Vol. 11**, 229-241.
Liang, G.S., Lin, S.C., Huang, W.C. (2003) The indices of competitive transshipment location mode on airport distribution center. **Proceeding** 3th **of the Eastern Asia Society for Transportation Studies**, 231-240.
Lin, S.C., Liang, G.S. and Ye, K.D.(2005) A survey investigation of airports as distributive centers: A strategic advantage perspective, **International Journal of Management**, **Vol. 22**, **No.3**. (Accepted)
Mahoney, J.T. and Pandian, J.R. (1992) The Resource-based View Within the Conversation of Strategic Management, **Strategic Management Journal**, **Vol. 13**, 363-380.
Narula, R. (1993) Technology, International Business and Porter's Diamond: Synthesising a Dynamic Competitive Development Model, **Management International Review**, **Vol. 33**, 85-107.
Pearce, J.A. and Robinson, R.B. (1991) **Evaluation of Multinational Environment in Formulation Implementation and Control of Competitive Strategy**, Homewood, IL: Richard D. Irwin, Inc., 139-141.
Porter, M. E. (1980) **The competitive advantages.** New York: Free Press.
Porter, M.E. and Millar, V.E. (1985) How information gives you competitive advantages, **Harvard Business Review**, July-August, 149-160.
Porter, M.E. (1990) **The Competitive Advantage of Nations**. New York: Free Press.
Porter, M.E. (1991) Towards a Dynamic Theory of Strategy, **Strategic Management Journal**, **Vol. 12**, 95-117.
Prahalad, C. K. and Hamel, G.(1990) The Core Competence of the Corporation, **Harvard Business Review**, **Vol. 68**, 79-91.
Rugman, A. M., (1991) Diamond in the Rough, **Business Quarterly**, **Vol. 55**, 61-64.
Toffler, A. (1980) **The Third Wave.** Bantam Books; Reissue.
Wernerfelt, B. (1984) A Resource-based View of the Firm, **Strategic Management Journal**, **Vol. 5**, 57-91.
Yager, R.R.(1978) On a general class of fuzzy connective, **Fuzzy sets and Systems**, 235-242.
Zadeh, L. A. (1965) Fuzzy sets, **Information and Control**, **Vol. 8**, 338-353.
Zadeh, L.A. (1965, 1976) The concept of a linguistic variable and its application to approximate reasoning, Part Ⅰ, Ⅱ and Ⅲ. **Information Science**, **Vol. 8**, 199-249, 301-357; **Vol. 9**, 43-80.