STUDY OF AIRLINES' CARGO HUB AIRPORT SELECTION – AN EMPIRICAL STUDY IN TAIWAN

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Abstract

This research employs AHP questionnaires to survey cargo airlines in Taiwan, and to identify the most important service attributes and the performance of the Taoyuan international airport (CKS) on these attributes. Of the many service attributes that influence an airlines' cargo hub airport selection behavior, "geographical location of airports" is perceived as the most important service attribute, followed by congestion and delay, operational availability, bilateral agreement, local demand, political risk, and airport user charge. According to previous literature, these above-mentioned attributes are some of the most frequently reported service attributes which influence an airlines' hub airport's selection behaviour. However, this research is one of the few researches that rank the importance and performance of the hub airports' service attributes using an empirical study through surveying major air cargo carriers in Taiwan.

Key Words

Hub Airport, Importance-Performance Analysis (IPA), AHP

INTRODUCTION

Taiwan's information and electronic manufacturing industry accounted for 23.6% of its manufacturing production in terms of value in 1995 (Fu, 1995). This figure grew to 36.43% in 2001, and is expected to reach 41% in 2011. Most of these information and electronic manufacturing products are heavily reliant on a good air transportation network to meet the challenges presented by rapidly changing markets (Kasarda and Green, 2003). According to the Association of Asia Pacific Airlines (AAPA, 2005), the Freight Ton Kilometre (FTK) growth rate is 18% in the Asian region: this is one of the highest growth figures in the world. A nation with a regional hub airport not only provides many job opportunities for its citizens (Button, 2002), but also increases the nation's export of information and electronic manufacturing products through high-density air route networking and frequent flight schedules. Thus, Taiwan's information and electronic manufacturing industry can seize market opportunities abroad as soon as they appear.

Currently there are four Taiwanese airlines and nineteen foreign airlines[1] providing direct air cargo

services linking CKS airport in North Taiwan with 66 airports abroad[2]. According to the Association of Asia Pacific Airlines (AAPA , 2005), in the Asia Pacific region, three of the top ten air cargo origin-destination city pairs originated from or were destined for Taipei in the first half of 2005. In fact, of the top ten cargo sectors between the two cities, Taipei-Anchorage and Hong Kong-Taipei are ranked as the only two city-pairs with semi-annual cargo traffics larger than 100,000 tones. However, Hong Kong-Taiwan air cargo traffic increased by 0.8% and Taipei-Tokyo cargo traffic decreased by 15.3% in the first sixth months of 2005. A way to read the airlines' minds and to avoid a decline in air cargo traffic in CKS airport, a major air cargo hub in Taiwan, is very important, from this airport authority's viewpoint.

LITERATURE REVIEW

Gardiner et al. (2005) reviewed freighter operators' choice of hub airport through reviewing the published literature, and identified location, airport quality and third-party influences as key factors in carriers' choice of hub airports. Tretheway and Kincaid's (2005) study examined airport competition and made clear that airports can compete by utilising the "four P's of marketing" strategy, and also indicate that cargo traffic is very price sensitive. Takase and Morikawa (2005) investigated passengers' hub airport and destination choices in Japan using repeated cross-section disaggregate air passenger data. Ohashi et al. (2005) employed a two–stage least square technique to study factors influencing carriers' choice of air cargo transhipment airports to and from Northeast Asia and indicated that the airport's current traffic flow patterns, airport infrastructure capacity and activities, linkage with regional and intercontinental airport networks, service quality and airport cost are the five major factors that carriers used to choose an air transhipment hub.

According to Frits and Matthias' (2003) study on commercial passengers' air travel and the failure of the hub, new carriers are able to provide better service at a lower price by avoiding large-scale hubs. This is because congestion generated by the hub system has eroded air travel's speed advantage, especially on shorter trips. Marianov and Serra (2003) presented a system model to locate the optimal location of air transport hubs in airline networks to minimise total cost, taking air traffic congestion into account. Tsai and Su (2002) used analytical hierarchical process methodology to assess the political risk if the Taiwan government intends to develop an air logistics hub in northern Taiwan. They indicated that air hub policy and inland freight policy are the top two factors influencing an airport's degree of political risk. Sasaki, Suzuki and Drezner (1999) considered the hub airport selection problem as a one-stop multiple allocation p-hub median problem, and formulated a cost-minimising algorithm model based on the number of passengers and the distance between the 25 U.S. cities they studied.

Nero and Black (1998) examined the increasing externalities associated with hub airports (including increase in environmental costs, e.g. airside and landside congestion, aircraft noise and emissions). Berechman and de Wit (1996) employed a simulation model to study the behaviour of

a hypothetical single airline in a competitive market setting, relative to its choice of hub airport. They found that air travel demand patterns, airline cost and production structure, aircraft type and airport charges and capacity are the major factors influencing the chance of an airport becoming the dominant gateway hub in Western Europe.

The extant literature is mainly focused on either passengers', shippers' or forwarders' hub airport selection behaviour (see Table 1); however, hub airports are highly dependent on airlines' patronage to thrive (Tretheway & Kincaid, 2005). There is no empirical research that surveys air cargo carriers' perceptions of the importance and performance of attributes influencing carriers' hub airport selection.

Table 1. Major influencing factors on a hub airport selection

Authors (year)	Research Foci	Major influencing factors reported
Gardiner et al. (2005)	Freighter's choice of airport	Location, airport quality, third-party influences
Tretheway & Kincaid (2005)	Airport Competition	Price sensitive
Takase & Morikawa (2005)	Passengers' hub airport selection	Passenger flow
Ohashi, Kim, Oum, & Yu (2005)	Forwarders'/shippers' choice of air cargo transhipment airport	Traffic flow patterns, airport infrastructure capacity, connecting times, service quality, airport cost.
Frits & Matthias (2003)	Carriers' selection of hub airport	Airside congestion
Marianov & Serra (2003)	Location of air transport hub	Air traffic congestion
Tsai & Su (2002)	Air logistics hub in Taiwan	Air hub policy, inland freight policy
Sasaki, Suzuki, Drezner (1999)	Hub airport selection	Number of passenger & distance between airports' service networks
Nero & Black (1998)	Hub airport externalities	Airside & landside congestion, airport noise & emission
Berechman & de Wit (1996)	Choice of hub airport	Air travel demand patterns, airline cost & production structure, aircraft type, airport charges, airport capacity

Source: this research

RESEARCH METHODOLOGY

The AHP model is employed because the numbers of air cargo carriers that serve the C.K.S. airport is very limited, meaning that the traditional Multivariate Analysis of Variance technique is not appropriate in this study. AHP includes four axioms: reciprocal relation, relation, pairwise comparison of homogeneous elements, hierarchic and systems dependence, and expectations about the validity of the rank and value of the outcome. The three steps involved in AHP applications are summarised below (Cheng et al., 2006):

1. Construct decision hierarchy with criteria related with the decision goal.
2. Collect input data to perform pairwise comparison of all the decision criteria.

3. Use an eigenvector method to estimate relative weightings of decision criteria.
4. Obtain a composite weight by aggregating the relative weights up the hierarchy to represents the relative importance of each alternative.

RESEARCH DESIGN AND STRUCTURE

A brainstorming session was held with three academicians in the National Penghu University to classify factors influencing carriers' hub airport selection into a hierarchical model, as shown in figure 1. Questionnaires were posted to two major Taiwanese airlines and eighteen leading foreign cargo airlines serving the CKS airport in 2006[3].

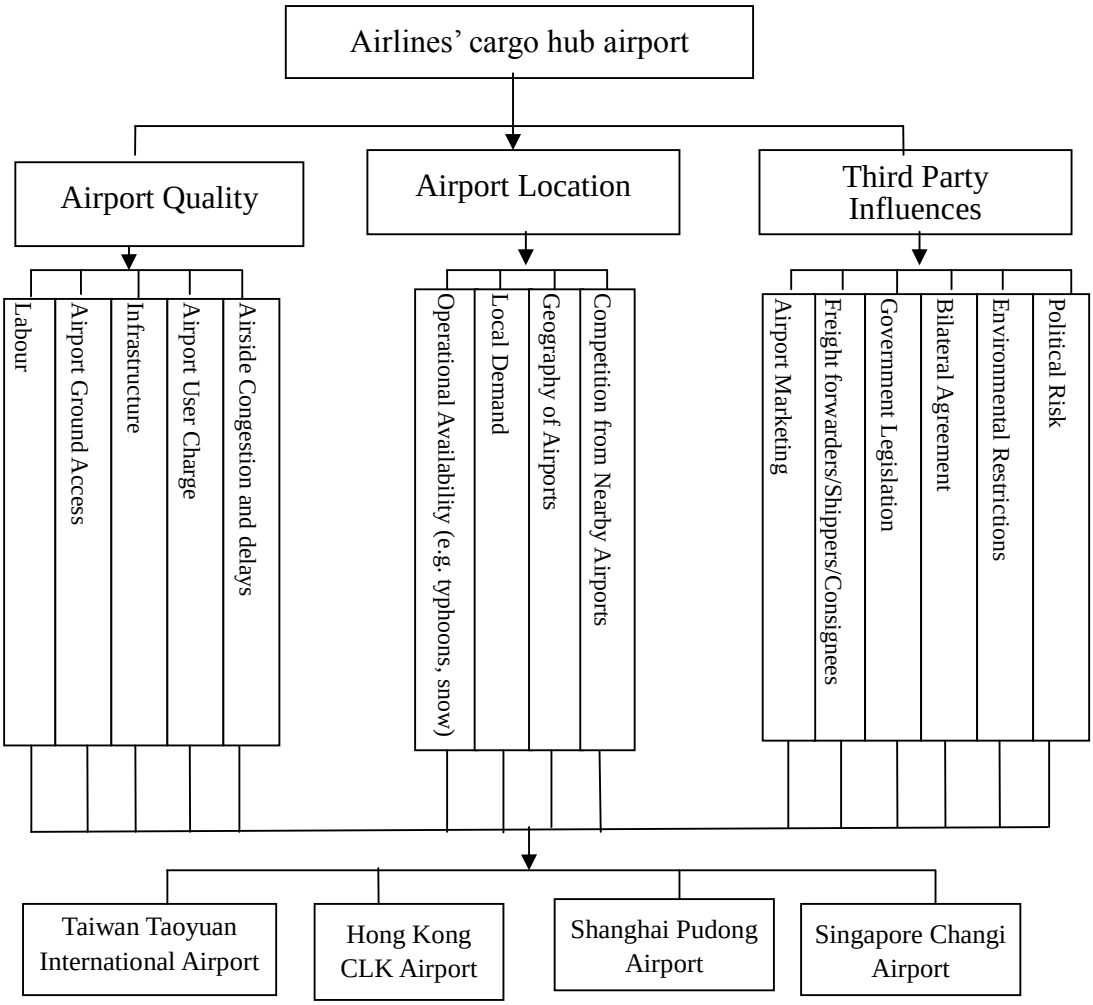

Figure 1. Airlines' freight hub airport selection and decision-making model
Source: adapted from Gardiner et al. (2005).

RESEARCH FINDINGS FROM PILOT STUDY

In the beginning of this research, a pilot survey were carried out through the author's personal networking, questionnaires were distributed to friends work in two national carriers and two foreign carriers respectively, and all the questionnaires were returned.

As shown in Figure 2, the ‘political risk’ (PR) and ‘congestion and delay’ (CD) service attributes were found to be important and the average performance of these two attributes was below the median value of the 15 service attributes employed to construct Figure 1. Put simply, the three airports in the greater China area should spend resources to improve these two service attributes to make themselves more appealing to air cargo transhipment users.

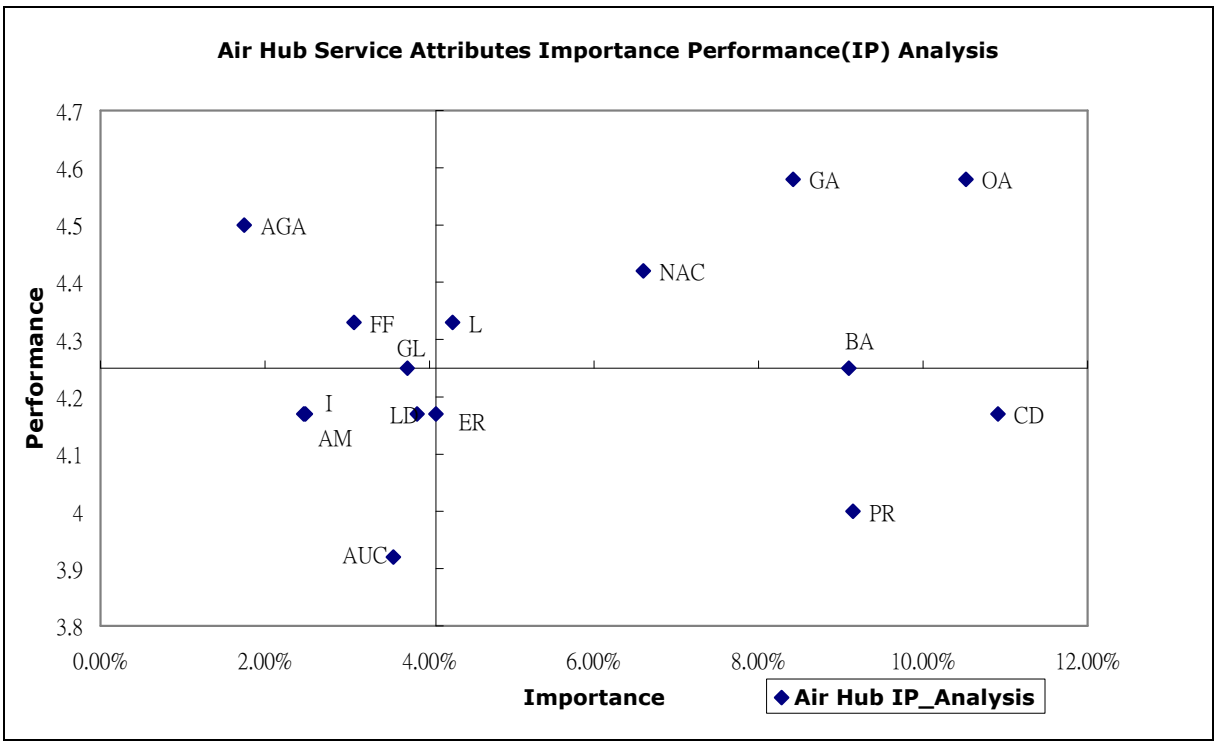

Figure 2. Importance-Performance Analysis of Airlines’ Cargo Hub Selection Criteria in the Pilot Study

Abbreviations: AM: Airport Marketing, GA: Geography of airports, LD: Local Demand, OA: Operational Availability, NAC: Nearby Airports' Competition, CD: Congestion & Delay, AUC: Airport User Charges, I: Infrastructure, AGA: Airport Ground Access, L: Labour, PR:Political Risk, ER: Environmental Restrictions, BA: Bilateral Agreements, GL: Government Legislation, FF: Freight Forwarders/ Shippers/Consignees, AM: Airport Marketing.

RESEARCH FINDINGS FROM MAIN STUDY

After the successfully returned of the questionnaires in pilot study, twenty copies of questionnaires were posted to major cargo carriers served Taoyuan International Airport. Telephone contacts were made before questionnaires were sent to the twenty surveyees. Surveyees employed ed in the pilot study were not included in the main study to avoid response bias generating by their learning effect. Souvenirs were also posted together with questionnaires to increase surveyees’ response rate. Twelve copies of questionnaires were replied by these cargo airlines staffs who are either managers or senior staffs work in their business or R&D departments (see Table 2.). As many respondents are

managers/senior staff who often travel within the great China region, and this enable them to evaluate the performance of the four major airports in the Great China region confidently. Thus credibility of the research result is enhanced.

Company	A	B	C	E	F	G
Job Seniority (yrs.)	10+	10+	10+	10+	10+	10+
Job Scope	Business	Business	Business	Manager	Business	Business
Company	H	I	J	K	L	M
Job Seniority(yrs.)	3~7	10+	10+	10+	10+	10+
Job Scope	R&D	R&D	Manager	Manager	Business	R&D

Table 2. Some of Respondents' Profiles

Source: this research.

A very similar research results to the pilot survey were found in the main study. The importance of each service attributes are ranked in the Table 3. The three major service dimensions have a very similar degree of importance.

Table 3. Importance rankings of cargo hub airports' service attributes

Major Service Dimensions	Service Attributes	Average Weight (Importance)	Ranking
Airport Quality (AQ)		**0.31**	
AQ	Labour	0.040	13
AQ	Airport Ground Access	0.052	10
AQ	Infrastructure	0.054	9
AQ	Airport User Charges	0.067	7
AQ	Congestion & Delay	0.096	**3**
Location (L)		**0.350**	
L	Operational Availability (e.g. Weather)	0.051	11
L	Local Demand	0.108	**2**
L	Geography of airports	0.111	**1**
L	Nearby Airports' Competition	0.080	**6**
Third Party Influence (TPI)		**0.341**	
TPI	Airport Marketing	0.017	15
TPI	FFW/Shippers/Consignees	0.036	14
TPI	Government Legislation	0.057	8
TPI	Bilateral Agreements	0.095	**4**
TPI	Environmental Restrictions	0.049	12
TPI	Political Risk	0.088	**5**

Source: this research.

Critical service attributes are the attributes have an above median value of importance but have a below median value of performance, and they are located in the lower right quadrant in Figure 3.

Again, the Congestion & Delay (CD) and Political Risk (PR) were perceived as critical service attributes by these cargo carriers. In addition, the Airport User Charge (AUC) was also perceived as a critical service attribute in the main study. This may result from the fast hiking of jet oil price between the time of pilot study and the time of main study. Expensive jet oil cost makes cargo carriers more sensitive to Airport User Charge (AUC) as these carriers are struggling to make their both ends meet. International airports in Hong Kong and Shanghai have a much higher landing fee for a Boeing 747-400 than their counterparts in Seoul and Singapore (Ohashi et al, 2005).

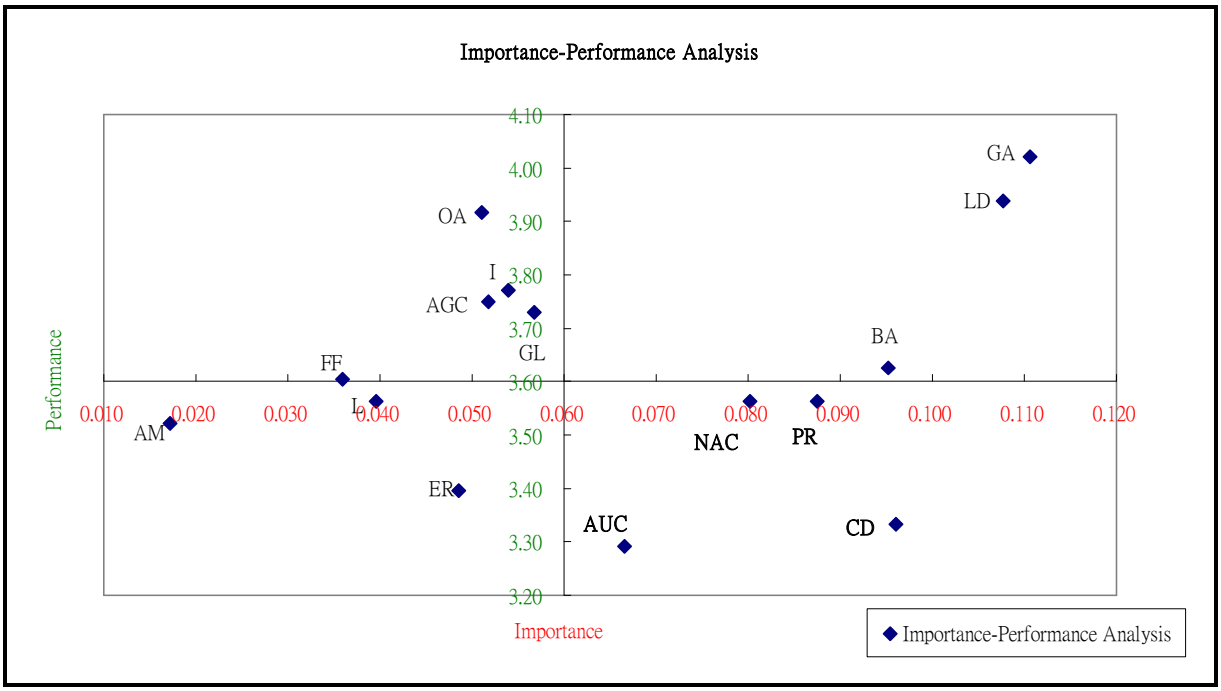

Figure 3. Importance-Performance Analysis of Carriers' Air Cargo Hub Selection in the Main Study

Abbreviations: AM: Airport Marketing, GA: Geography of airports, LD: Local Demand, OA: Operational Availability, NAC: Nearby Airports' Competition, CD: Congestion & Delay, AUC: Airport User Charges, I: Infrastructure, AGA: Airport Ground Access, L: Labour, PR:Political Risk, ER: Environmental Restrictions, BA: Bilateral Agreements, GL: Government Legislation, FF: Freight Forwarders/ Shippers/Consignees, AM: Airport Marketing

The rankings of the four cargo hub airports' overall performance perceived by the 12 carriers surveyed do reveal that Hong Kong CLK has the best overall performance, despite its highest AUC (airport user charges) among these four airports. Singapore's and Hong Kong 's overall performances are very close, and Taipei International outperform Shanghai Pudong with a minor margin (see Figure 4). In short, the Shanghai Pudong airport is ranked the last among the four airports surveyed.

However, as one of the surveyees indicated that Taiwan's air cargoes transport growth rate has already slowed down significantly since 2003. Because of carriers' strategic alliance practice and transhipment policy prevails among the Asian air cargo markets, every kilometer ton of Europe and

North America bound Asian air cargoes can generate four kilometre tons of transport activities within the Asia region. Eastern China exportes many air cargoes that are currently transhipped through Hong Kong CLK airport, although the CLK has a much higher airport user charges than the CKS airports in Taiwan. If a cross-Taiwan Strait direct air links cannot be established within a short time period, then this surveyee has predicted that the CKS airport's overall performance will be ranked the last in the very near future.

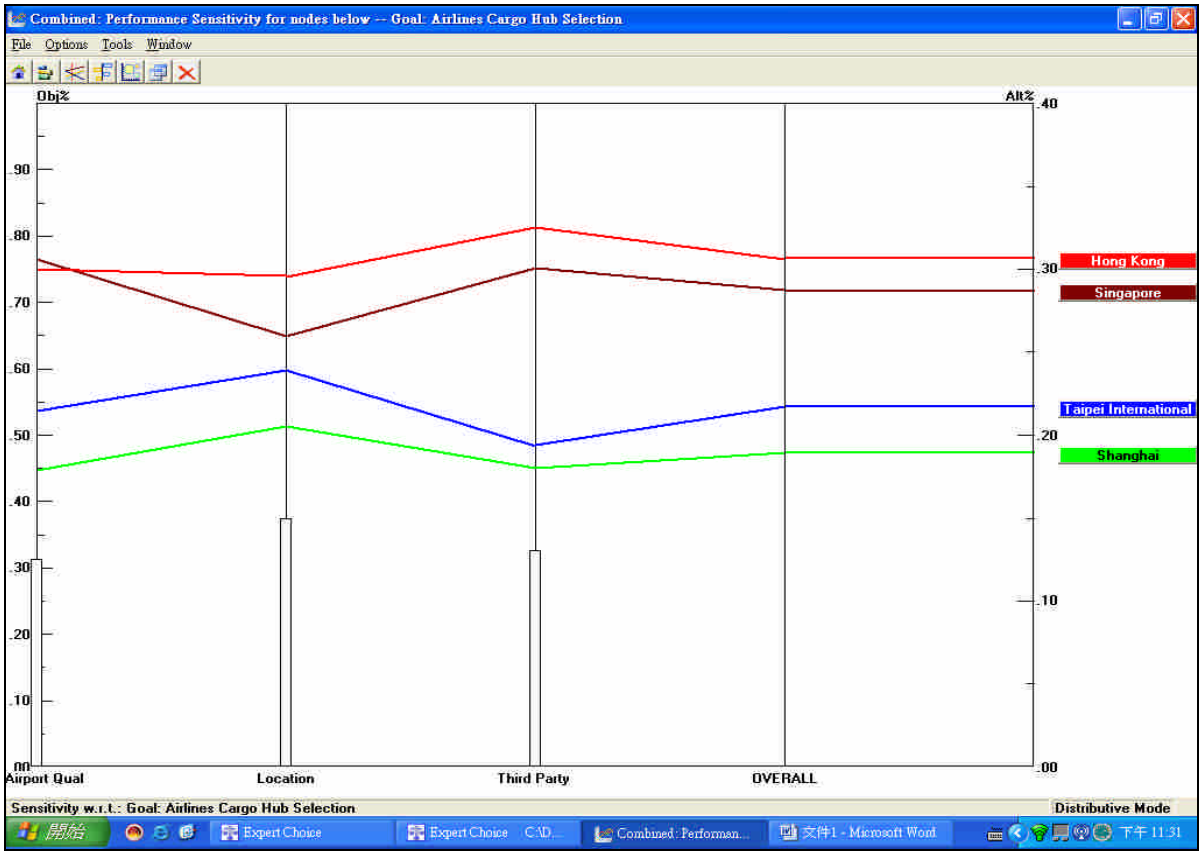

Figure 4. Ranking of four major hub airports in the Great China Region

Source: this research

CONCLUSION AND SUGGESTIONS

'Political risk' and 'congestion and delay' are two sides of a coin in the three airports under investigation in this study. The trade volume between Mainland China and Taiwan has been increasing in leaps and bounds since 1988. Indirect air traffic links between Taiwan and Mainland China through Hong Kong double the air traffic volume in the sky in this region. From the viewpoint of the development of these three air cargo hubs' in greater China', a healthy communication channel should be built between Taiwan and China's civil aviation authorities and direct air traffic links across Taiwan Strait should be made possible. Thus, not only can the 'congestion and delay' situation be improved; 'political risk' can also be significantly reduced under the conditions of friendly direct air service links. Airport users charge (AUC) is one of the most important criteria for carriers to select a cargo hub airport, carriers' sensitiveness intensity on AUC was found increased during the period between pilot study and main study. This suggests

cargo hub airports should have a more flexible pricing policy to help carriers overcome their financial difficulties during their business recession period.

The focus of this research is limited to analysing major service attributes of air cargo hubs in only four airports in the great China region. Further research is suggested to include airports in Europe and America, so that a more comprehensive view on the importance of air cargo hubs' service attributes can be revealed. Belly cargoes are another major way to transport high value product with more frequent flights service. Service attributes' importance should be different between all cargo flight carriers, belly cargo carriers, and combined carriers, looking into these differences may be another avenue for future researches.

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[2] Available at http://www.cksairport.gov.tw/CKSchi/schedule/airline_c.jsp#, accessed on 2006/4/28.

[3] According to Taiwan Taoyuan International Airport's website, there are 19 foreign international air cargo carriers served Taoyuan International Airport, however the author has contacted Martin Air by telephone and found Martin Air had stopped serving Taiwan since 2004. Thus only eighteen foreign carriers were posted questionnaire.