National Chiao Tung University

Institute of Traffic and Transportation

Thesis

兩岸直飛政策對台灣航空產業之影響研究

Analysis of the Impact of Direct Flight Policy on

Taiwanese's Aviation Industries

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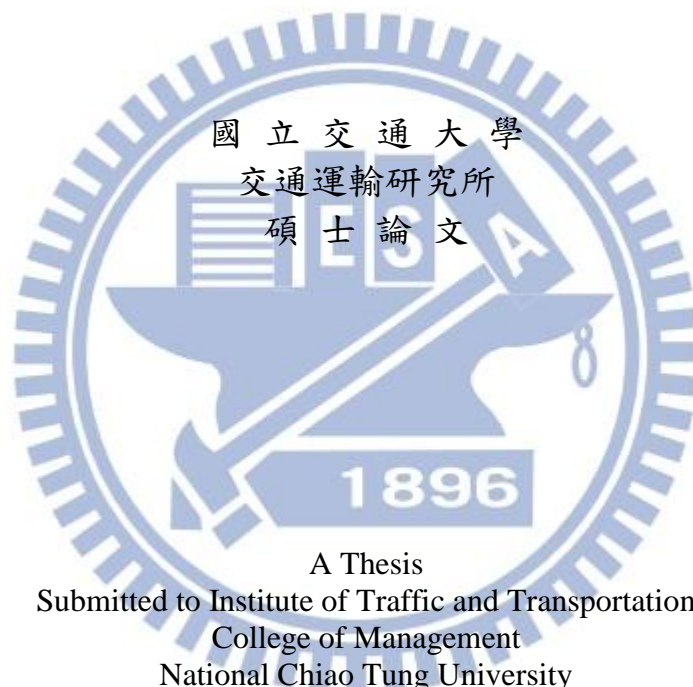
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Abstract

For over half a century, there was no direct air transportation between Mainland China and Taiwan due to some political issues. However, the need for communication, trade exchange and globalization demand direct flight between the Taiwan Strait. After many years of negotiation, both sides of the Taiwan Strait have agreed to sign a series of cross strait agreements that help to facilitate the contact and develop the economics of both sides. In a general way, transportation system improvement can spread reductions in cost and gains in productivity through all the economic sectors that produce or distribute good. Improvement in transportation policy and/or planning can be expected to have important economic effects on carrier's performance, shipper's performance and the whole region economy.

The purpose of this study was to investigate the behavior of the relationship among stakeholders. Another aim was to find out the effect that can provoke signing an Air Policy between Mainland China and Taiwan. Finally, establish factors in which Air Policy effect would be assesses. By this way determine which factor is more desire for each stakeholder was examined in the study. The research study used survey questionnaire to examine the opinion and desire of aviation industries with respect to the Cross Strait Air Policy effect that could have on their industries. Questionnaires were sent out to airlines companies, high tech industries and governments. All stakeholders asked to carry out the questionnaire have trade and economic activities between Mainland China and Taiwan.

The results of the study were that government could contribute in the enhancement of freight transportation system. Policies released could help not only in the improvement of

freight transportation systems, also, enhancing services quality within the freight transportation system. Additionally, it was found that the introduction of air policy could change industries performance. As air policy is introduced, airlines would have the freedom to decide if they want to serve or not a market. When airlines industry served a new market, they could experiment growth in many aspect of their industry activities such as new services, more traffic, more jobs and economic growth. On the other hand, new and better air services could attract and influence in some decision and performance of other industries such as manufacturing and high tech industries. Further, it was discovered that there are many weakness in Taiwanese transportation system which Taiwan government needed to care more about.

Moreover, some suggestion for aviation industries would be provided. As government plays a very important role in the freight transportation supply chain, they should develop better mode of planning and forecasting of capacity demand. Besides, as the implementation of the Cross Strait Air Policy is still recent, shippers can meet and test carrier's services quality. After ensured that carrier meet their necessity, shipper could strength their relationships. In addition, suggestion for carrier is also provided. The Cross Strait Air Policy only allows Mainland China and Taiwan airlines to have direct flight between both sides. However, only several airport at Mainland where opened for Taiwanese airlines to call at them. Asides, Mainland China has domestic air regulation in which the markets are served by specific Chinese airlines. As suggestion for Taiwanese carriers is to make alliance and partnership with Mainland China airlines, by this way, Taiwanese airlines can provide better services and complete freight flight connection for their customers.

The results revealed that each aviation industry stakeholder had different concern and desire with respect to the effects that Cross Strait Air Policy could bring to their companies. In short, policies could make freight transportation become faster and reliable. Therefore, the flow of goods could be managed with more efficiency. As a result, firms could maximize their benefit and welfare by enhancing their company's performance.

KEYWORDS: Cross Strait Air Policy, Cross Strait Direct Flight, Aviation Industries, Freight Transportation System

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Analysis of the Impact of Direct Flight Policy on Taiwanese's Aviation Industries

I. Introduction

This thesis research studies the impact of having Direct Air Transportation Policy signed between Mainland China and Taiwan. The purpose is to determining the effects of Cross Strait air policy have on the different Taiwanese Aviation Industries. In this research study, airlines industries and high technology industries would be the aviation industries studied. In this chapter, research background would be provided for further understanding for the reader. Research motivation and objective would be given for comprehension of the intention of this thesis research. Besides, research flow would be presented.

1.1. Research Background

With the globalization and industrialization, businesses are looking for more spatial expansion of their economy, this provoke the growth of trade and as consequence increase the demand for freight transportation.

Figure 1. Components in the Economic System
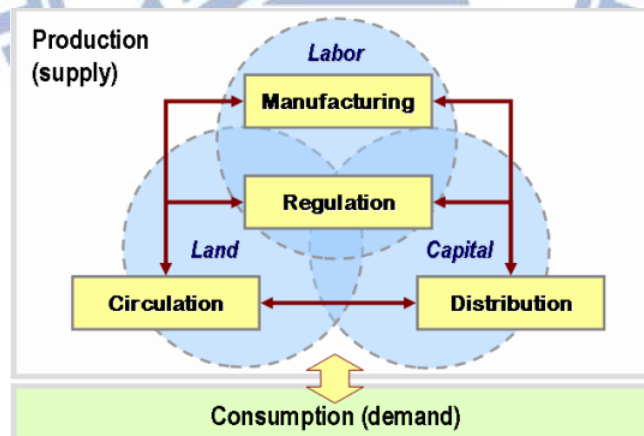
Source: The Geography of Transportation System

Jean Paul Rodrigue states that the realization of production and consumption cannot occur without flows of freight within a complex system of distribution that includes, modes, terminals, but also facilities managing freight activities, namely distribution centers.

Production and consumption are interrelated through the conventional supply / demand relationship as shown in figure 1, Components in the Economic System.. [1]

Regulation can control and/or restrict firm to develop a strong economy which mean that can lower the firm logistic productivity and as consequence can affect their customer logistic activities. Regulation is mostly the role of government. Regulation has different level such as national, state, and cities level. Hence if manufacturing firm wants to export their good to X countries, they could not do it without national public policy that allow the entry of the good to X countries. Airlines also have restriction entry to certain countries; airlines cannot to flight into those countries if there is no public policy. As well as, there are national public policies that restrict entry to others countries, inside the state and cities there are also policies that regulate the production, distribution and consumption activities. As the activities is take place in urban areas, mitigation plan exist to minimize externalities cause by economic activities. Policies restrict trade and transportation growth. Relaxing public policies would allow firms to invest in transportation and infrastructure by this way can help in the competitiveness and productivity of transportation and trade firm; this can bring a good movement growth. Surely, these economic activities would impact the land use, economy, distribution, community, environment and business.

Figure 2. Relationship among stakeholders
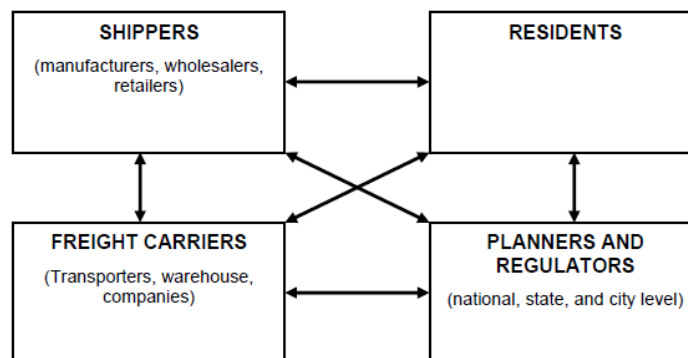
Source: The City Logistics paradigm for urban freight transport

The understanding of each stakeholder behavior can help to understand how a public policy would change shippers and carriers logistics system. In the relationship among

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[1] Jean Paul Rodrigue et al, The Geography of Transportation System, 1998.
[2] CAO Report, Freight Transportation National Policy and Strategies can help Improve Freight Mobility, Jan 2008.
[3] *Wikipedia.* February 08, 2012. <http://en.wikipedia.org/wiki/Cross-Strait_relations#Before_1949>.

stakeholder, each group has its own objective and tends to behave in different manners. So, if conflict between stakeholders takes place, this cause the change in other stakeholder and may strongly affect the balance of the others.

In a general way, transportation improvement can spread reductions in cost and gains in productivity through all the economic sectors that produce or distribute good. Improvement in transportation policy and/or planning can be expected to have important economic effects on carrier's performance, shipper's performance and the whole region economy. In freight transportation system, carriers would be the first in be benefit with public policies. Then, carriers' improvement would impact shipper performance decision and so on. As part of the freight transportation is developed in the city and/or nearby the cities, other consideration would be taken in consideration due that will affect communities and resident living nearby these economic activities.

Figure 3. Transportation and Economy
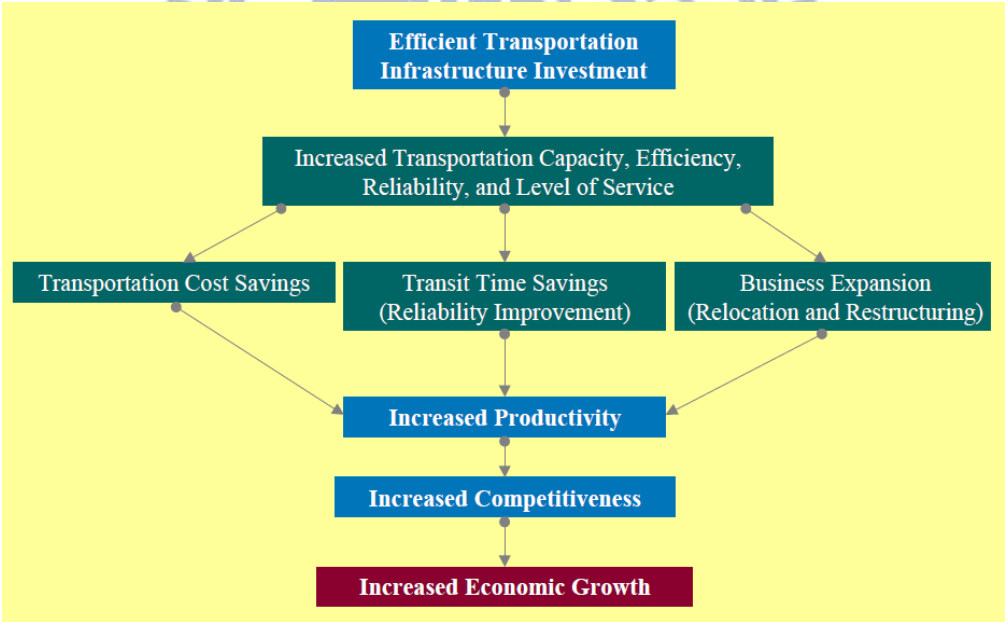
Source: Economic Effects of Transportation: The Freight Story

Cargo movement is very important to the performance of the national economy. Many studies suggest that increases in freight volumes have strongly relation with increases in productivity and the gross domestic product. Constant development and efficient management of the nation's transportation system such as highways, rail lines, maritime, and air are

important to sustaining the nation's competitive position in the global economy. Transportation system helps to connect international gateways and intermodal facilities to retailers, producers, and consumers.[2]

High technology producers are increasingly reliant on air carriers from around the world. In order to increase their profitability, producers are finding global markets for the sale of their products. Additionally, to control costs, producers often relies on prompt, timely shipments of materials in small batches and have implemented inventory management systems that lower overall costs by relying on prompt shipping of needed goods, instead of more costly warehousing.

An inefficient transportation system can led to a number of adverse effects causing higher direct economic costs for carriers, producers and consumers; and higher indirect costs, such as costs that can affect the quality of life of all transportation users. Growth of transportation demand, geographic barriers, transportation policies, transportation capacities, inefficiencies infrastructure are some factor that can contribute to constrained freight mobility. In the case of Taiwan, not having an air transportation policy with Mainland China harms the efficient flow of the nation's goods and hence affects air transportation carriers and shippers.

The particular situation of Taiwan and Mainland China dates back to the year 1949. Due to the civil war before 1949, the political relationship between Mainland China and Taiwan had been cut off and therefore their communication, transportation and trade had been affected since then. Since 1949, the relations between mainland China and Taiwan have been characterized by limited contact, tensions, and instability.[3] For years, the political tension at Taiwan Strait has blocked any kind of direct air and/or maritime link for communication, transportation, postal and trade. The only ways to get to each territory side are by sea or air transportation mode; there is no road transportation mode link because Taiwan is an island located off the southeastern coast of Mainland China.[4]

In the absence of a direct air link between Mainland China and Taiwan, passenger flight and trade were usually made through a third parties connection link. The lack of direct air flight was the consequence of the mistrust after the Chinese Civil War. Then after the war, no direct flights were permitted between Taiwan Strait because of security concerns and to protect the sovereign of the Taiwan's government.

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[2] CAO Report, Freight Transportation National Policy and Strategies can help Improve Freight Mobility, Jan 2008.
[3] *Wikipedia.* February 08, 2012. <http://en.wikipedia.org/wiki/Cross-Strait_relations#Before_1949>.
[4] *Wikipedia*. February 08, 2012. < http://en.wikipedia.org/wiki/Taiwan>

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The link between the two sides of the Taiwan Strait was routed through intermediate destinations. Passenger and cargo flight had been required to stopover in at least one transit airport before reaching to Taiwan or Mainland China. On those times, airline companies that flight Mainland China and Taiwan destination usually used Hong Kong, Macau, South Korea, Japan, or Southeast Asia countries as their intermediate destination. [5]

According to Cheng Chang Lin and et al., on 2003, airlines companies that served the Taiwan-Mainland China link had their own exclusive and preferential transit airport to do a stopover before fly into Mainland China or Taiwan, as can mention:

- FedEx used Subic Bay located at Philippine as its transit airport.
- UPS, China Air, Cathay, and Dragon used Hong Kong as their transit at airport.
- Eva Airway used Hong Kong or Macau as its transit at airport.

Figure 4. Cross Strait Air Transportation Policy history
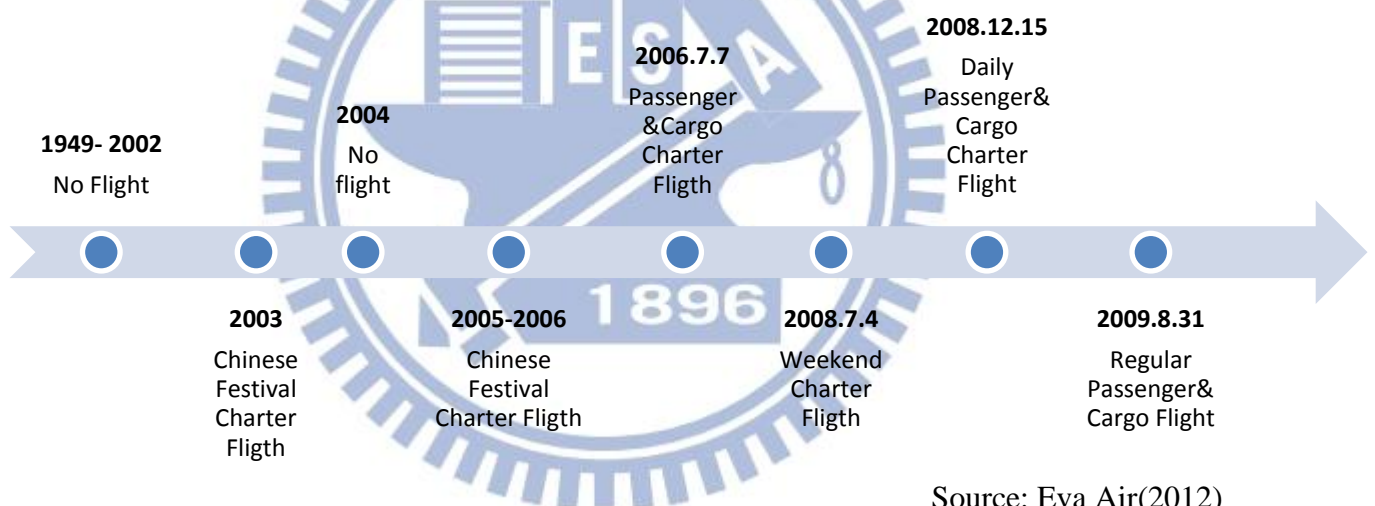
Source: Eva Air(2012)

The economic development and the trend of global trade would make businessmen and aviation industries to claim for air transportation cross the Taiwan Strait.[6] According to Mr. Chong An-Jian, airlines usually provide routes where a demand market exist otherwise they will not risk their business. On 2008, air transportation began to open progressively according to the demand market and flight restrictions were removed allowing any citizenship to take

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[5] Cheng-Chang Lin, *The integration of Taiwanese and Chinese air networks for direct air cargo services* (Elsevier Science Ltd), 633.

[6] Wang Lu, Liu Yumei, Li Hongtao Zhu Yaowen, *The impact of direct air transportation link cross Taiwan Strait on air passengers transportation of China mainland, Taiwan, Hong Kong and Macao* (CAAC), 1.

Cross Strait flight (Wikipedia). In July 2008, Cross Strait charter flights expanded to weekends. Few months later, charter flights became daily. Then, weekly flights were established and the planes no longer had to travel through Hong Kong airspace, saving in travel times and operational cost.

Even though both of the Taiwan Strait sides have political problem, the Cross Strait trade exchange between Mainland China and Taiwan grew rapidly. There were many authors like Cheng-Chang Lin that stated that the two sides of the Taiwan Strait perform mutually dependent but complementary activities in the global manufacturing supply-chain. With the need to ease the mobility across the strait and with the growing economic ties, direct air links are inevitable.

Even before the direct air transportation agreement been signed between Mainland China and Taiwan, they were depending from each other in order to supply themselves with the different kind of commodities located at Mainland China or Taiwan market. Based on the table 1, Taiwan join more benefit with the exchange trade they have with its counterpart. This is due to the size of the market at Mainland China.

Table 1. Trade between Taiwan and China

Year	Export from Taiwan to China			Import to Taiwan from China			Surplus
	Amount	Percentage	Growth rate (%)	Amount	Percentage	Growth rate (%)	
1991	6928	9.09	66.1	1126	1.79	47.1	5802
1992	9697	11.9	39.96	1119	1.55	-0.61	8578
1993	12,728	14.96	31.26	1016	1.32	-9.25	11,712
1994	14,653	15.75	15.13	1859	2.18	83.03	12,794
1995	17,898	16.03	22.15	3091	2.99	66.32	14,807
1996	19,148	16.52	6.98	3060	2.99	-1.02	16,088
1997	20,518	16.81	7.15	3915	3.42	27.96	16,603
1998	18,380	16.62	-10.42	4110	3.93	4.99	14,270
1999	21,221	17.5	15.5	4526	4.1	10.1	16,695
2000	26,162	17.6	23.3	6223	4.4	37.49	19,939

Source: The integration of Taiwanese and Chinese air network for direct air cargo services

C.C.Lin has analyzed the supply chain between China and Taiwan, and he stated that China is a procurement market for products manufactured in Taiwan. Other reason stated by him is that China is Taiwan's outdated machinery market. And third, he stated that Taiwan provides high technology parts for the Chinese domestic market.

Another cause that makes society claimed for direct flight, according to Chong An-Jian because of the lower labor and operational cost at Mainland China, many Taiwanese move their factories there. Usually their factories and industries center are located are located close to Jinhai area but recently because the salaries in those areas are becoming higher then industries began to move their business to the western part of china. As the western part of China only can be operated by China airlines, the Cross Strait air policy play an important role allowing airlines to form alliance and code share some route (Chong An-Jian).

In April 2009, a new agreement was created to permit cross-strait flights to become regular scheduled flights. After air liberalization and with the help of the ECFA that promote the liberation of trade between Mainland China and Taiwan, the Cross Strait Air Transportation Agreement seem to continue adding more destination point and flight frequency would increase across the Taiwan Strait.

The first step for improving air freight transportation system begins with the signing of the Cross Strait Direct Air Transportation Agreement. Immediate transportation cost reduction and travel time saving are gained by carriers and shippers. However, others effect would bring with the enhancing of transportation system.

But the enhancing of transportation system can affect positively others industries that relied on transportation for their logistics activities. Improvement in freight carriage can be expected to have important economic effect (ICF Consulting). In short, freight transportation improvement can spread reduction in cost and gains in productivity through all the economic sectors that produce or distribute good. So relaxing policies can be truly valuable contribution to the efficiency of the whole economy.

This thesis research would study the consequence that Cross Strait Air Transportation Policy has on air freight transportation system, high tech industries logistics and economy; and investigate which factors is more importance for each freight transportation stakeholders.

1.1. Research Motivations

China and Taiwan had no air transportation agreements mainly caused by political problems. The problem of not having air transportation policies to connect Mainland China and Taiwan affect freight transportation system and the whole economy. The constant pressure of aviation Industries has contributed with the signing of Cross Strait Air Transportation Agreement. Many literature and IATA studies state that relaxing restriction can allows airlines industries reorganize their industries and therefore let them provide better service quality to their customers.

Figure 5. Relationship between Air Service Liberalization and Economic Growth

Source: The Economic Impact of Air Service Liberalization- Inter*VISTAS*-ga2

Figure 6. Air Service Liberalization and its impacts
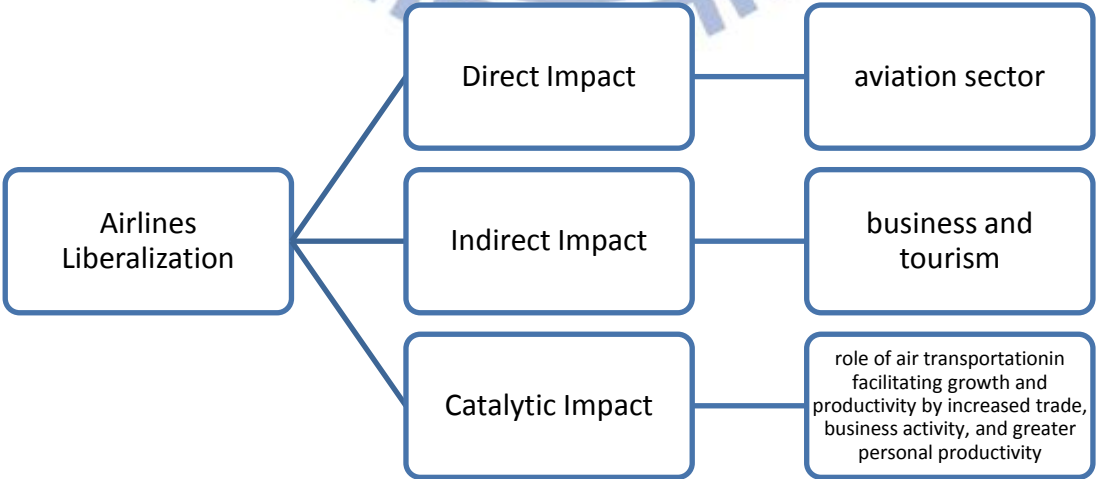
Source: The Economic Impact of Air Service Liberalization- Inter*VISTAS*-ga2

Subsequently to air carrier improvement, many literatures suggest that improvements in freight carriage can be expected to have important economic effects and that improvement in freight transportation system would bring welfare also to carrier user such as manufacturing, distribution center, wholesaler, retailer and others. Since freight transportation facilities and activities usually are located nearby the cities or in the cities, others effect will influence the society in a direct or indirect way.

Figure 7. Effect of Air Service Liberalization on other Industries
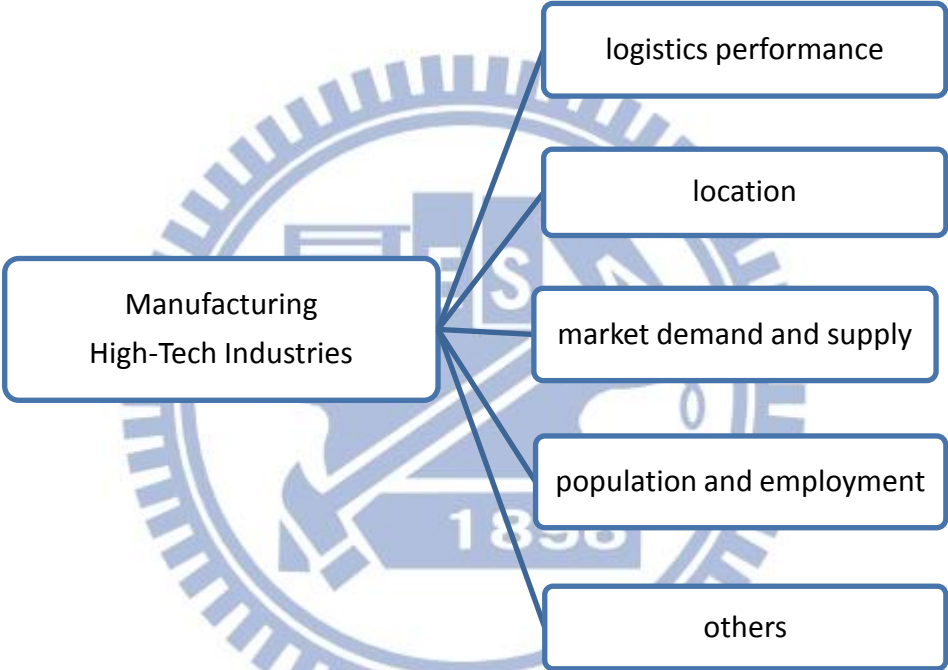
Source: Economic Effects of Transportation: The Freight Story

The motivation of studying this topic is to know how an efficient and reliable freight transportation system helps to generate improvements in economic productivity. And improvement in carrier's services can influence in the shipper industry performance and behaviors. My personal motivation for studying this topic is with the objective of gaining more knowledge about transportation management.

1.2. Research Objectives

The objectives of this thesis research are listed as follows:

1. Identify the problem that carrier, shipper and society have to confront in the freight transportation system. The objective is to identify how the change in behavior of one stakeholder can influence in the economic activities of the other stakeholder.

2. Investigate the effect that can provoke Direct Air Transportation Policy on carrier, shipper and society. The study would try to investigate how airlines can maximize their profit benefit when no restrictions restrict them from improving their industry logistic performance. On the other hand, by improving logistic in airlines industry how transportation would influence on manufacturing and distribution productivity and logistics.

3. Establish criteria of the effect of Direct Air Transportation Policy for carrier, shipper and society. After reviewing literature about deregulation and freight distribution system, I would try to determine if in the Cross Strait any change have been produced.

4. Determine which criteria are more important for each aviation industries stakeholder.

5. Analyze each criteria and sub-criteria degree of importance of judgment.

1.3. Research Scope and Flow

Following, the research framework is presented in order to give lectors a view about the flow of this study.

Firstly, the air Cross Strait problem and literature review would go to be review for further understanding about the Cross Strait Air Transportation situation and stakeholder desire. Then, proceed with the content analysis where the determinant point is to establish within the area of interest what are the main reason, conflict and criteria that should be taken in consideration in the study of this research about having a Cross Strait Direct Air Transportation Policy.

After depth analysis, questionnaires would be formulated for the development of survey. After gathering of data, the analysis of the effect on Taiwanese Aviation Industries would be done using the AHP approach where methodology would be described on follow chapters. Finally, the result and conclusion would be given according to the data collected by the survey.

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│          Problem            │
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┌─────────────────────────────┐
│      Literature Review      │
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│       Content Analysis      │
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│           Survey            │
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│         Assessment          │
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│        Data Analysis        │
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┌─────────────────────────────┐
│     Result and Conclusion   │
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Figure 8. Research Flow

II. Literature Review

The literature review chapter would provide review about problem and behavior of carriers and shippers are facing. Besides, methodology literature and impact of having direct air transportation policy on aviation industries would be reviewed. This research study seeks to figure out the benefits generated by opening Cross Strait direct air transportation. Improvement in airspace-freight carriage is one of the ways that government can make a truly valuable contribution to the efficiency of national economy.

2.1. Aviation Industries Development

This research study investigate the many ways that government policy decisions have affected (or could affect) the freight system. Potential effects include shifts in freight mode as well as changes in the following: costs to freight carriers, revenues to freight carrier, costs to freight shippers, freight volumes, freight service quality, freight operations, freight system safety and freight fuel use or emissions. Public Policies can relax or restrict freight transportation of having a good logistics and therefore would impact on their services quality.

As freight transportation become faster and more reliable, hence more predictable, the flow of good and the stocking of good can be managed more efficiently. In other words, policies allow firms to reorganize their logistic and consequently can help firms to maximize profit benefits. Nadiri (1996) uses a cost function approach to estimate the relationship between capital investment and productivity in US. After reviewing some literature, many studies found that the improvement in freight transportation logistics can help increase the productivity of manufacturing, and distribution in many ways.

As mentioned in the research background, in order to be able to enter country airspace air agreement is needed between both territories. Air cargo, of course, does not operate in a vacuum. Its economic impact can be contingent on numerous factors, including the country's overall logistics infrastructure as well as the country's broader commercial and policy environment in which the air cargo industry operates (Doganis, 2001). John Kasarda(2005) state that three factors that enhance air cargo's positive impact are air service liberalization, improving customs quality, and reducing corruption.

Such implementation of Airline deregulation can result in stopping government controlling fare and determining which carriers can serve which market and among other restriction depending on each country public policies. Therefore, deregulation inevitable

brings significant economic effects. The effect of deregulation cannot be assessed simply by comparing welfare before and after deregulation because change in key variables such as fares and profits from regulation to deregulation reflect input price changes as well as the regulatory change.

One must compare the welfare levels achieved under an actual regulatory regime with the welfare levels that would have been achieved had an alternative regulatory regime been in effect at that same time.

Steven Morrison and Clifford Winston(1986) state that users and carriers would clearly benefit from an expansion in carriers operations, although the cost, in term of potentially higher fares, would be largely borne by users.

Steven Morrison et al concluded that aviation industries is tied to capital structure created under government regulation and when it has not fully adjusted to deregulation the benefit achieved thus far should be still greater in the long term. Consequently, they advise continued vigorous pursuit of policies that promote competition in deregulation airline market.

2.1.1. Efficiency Effect on Carriers

To estimate the effect of deregulation on carrier welfare the most accurate prediction is by finance performance. Steven Morrison et al suggested a measure of carrier finance performance.

There are some benefits that airlines can gain with the implementation of public policies however is wrong to said that only with the deregulation, airlines can gain it. The deregulation roles in airlines help them to maximize the benefit. Policies would provide carriers freedom and accessibility to larger market. George William (1993) stated that some immediate welfare benefit carriers would gain are in travel time saving and operational cost saving. In response to economic freedom, airlines would react to competition.[7] Carrier can take full advantage deregulation by improvement in network by code sharing, alliance, computer reservation with other airlines, frequency flyer program, hub and spoke network, investment in advanced logistics, and their whole industries reorganization.

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[7] George William, The Airlines Industry and the Impact of Deregulation, 1993-1994. In response to economic freedom, airlines would react to competition.

Deregulation allows carriers to change the way passenger booked and acquired their ticket. On the other hand, cargo carriers would concern about the flow of information between customers, forwarder, cargo terminal and custom officer. As a result of improvement of computer reservation system and/or cargo information system, carriers could save cost and serve more market by the use of agents.

Case of Taiwan Cross Strait

Cross Strait direct flight policy provoke immediate cost reductions and travel time saving to air carriers as shown in the following Table N°2. For carrier, the gain of welfare is huge in respect to shorten the distance and travel time of route. As result, carrier gain welfare in travel time. All this change provokes gain in their logistic, fuel, labor and operational cost (Eva Air). The travel time of before the Cross Strait Direct flight policy being signed would be different in each airlines companies. As airlines companies have different third parties countries for connection to Mainland China, the different of travel time and distance are unlike.

Table 2. Travel Time Saving-Change in travel time during the different period time

Route	2003-2008	2008 Month 12	2009 Month 8
Taipei-Shanghai	2:25	1:21	1:21
Shanghai-Taipei	2:22	1:24	1:22
Taipei-Beijing	3:41	2:44	2:44
Beijing-Taipei	3:35	2:43	2:43
Taipei-Guangzhou	1:35	1:35	1:28
Guangzhou-Taipei	1:33	1:33	1:33
Taipei-Shenzhen	1:28	1:28	1:24
Shenzhen- Taipei	1:21	1:21	1:14

Source: Eva Air (2009)

Hub and Spoke Network

Aviation industries is a very huge topic but In order to understand better about the criteria taken in consideration on the direct air agreement it is necessary to comprehend about the Airlines Network (Chang, 2003) and basic thing about this industry.

The structure of an airlines network is a result of airline route planning, which is aimed at maximizing network revenue[8]. As Richard Wu stated that the driving force of airline route

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[8] Wu, Richard. *Introduction to Airline Operations and the Operating Environment*, 3.

planning is deeply rooted in corporate revenue maximization. Therefore, the airlines network development will be an important attribute in determining the competitiveness of airlines (Lau et al.2012) by choosing good airport for airlines network, airlines can minimize operational cost and generate more profit to their corporation.

In the aviation industries, airlines can develop different kind of services offer according to their business strategies (Airport Competition, page 138). The different services that airlines can give are only passenger services, only cargo services and the combination services. The combination service is when an airline uses the belly cargo space of a passenger flight to allocate extra cargo services.

Airlines cost can be calculated by the seat load factor and weigh load factor (Lau et al.2012). There is a different between seat load factor and weigh load factor. Seat load factor is a measure of the amount of utilization of the total available capacity of a transport vehicle. It is useful for calculating the average occupancy on airlines.[9] On the other hand, weigh load factor is the measure of passenger seat capacity plus the cargo capacity in the same vehicle, aircraft.

Figure 9. TransAsia Airway Cross Strait Flight Routes

Source: TransAsia Airway Website (2012)

Another interesting data about Mainland China air transportation is that the country protects their countries flag carriers and has their airport classified into national, regional and

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[9] http://en.wikipedia.org/wiki/Passenger_load_factor

local airport based on their connectivity to others airports (C.C. Lin). The Civil Aviation Administration of China (CAAC) decentralized the airline industry into six aviation bureaus and six corresponding airlines that serve those regions. The regions are north China (Huabei), east China (Huadong), central and south China (Huazhong and Huanan), northeast (Dongbei), southwest (Xinan) and northwest (Xibei). For each of the six regions, there is commonly more than one main airport.

In the north region, the driver of air cargo growth is due to high tech industry in Beijing and Tiajin areas. In the eastern side, air cargo growth is due to economic strength of it catchment area, the Yangtze River Delta. In the central and south region, the air cargo growth is due to the strength of industries base in Pearl River Delta, construction of new airport in Guangzhou and other logistics services facilities in the area. In the southwest region, since this region relies heavily on natural resources, faster growth is likely to boost cargo throughput. In the northwest and northeast region, the impact of air cargo is minimal due that air cargo traffic sent from the Northwest or Northeast still has to pass through Beijing.

Table 3. Major airlines regions of China

Region	Share of GDP	Share of import plus export	Major airports	Share of aircraft movement	Share of passenger throughput	Share of cargo throughput
North China	12.6%	11%	Beijing	13.8%	18%	22.2%
East China	37.7%	40.6%	Shanghai, Xiamen, Hangzhou	26.2%	29.2%	34.4%
Central and South China	26.1%	39.8%	Guangzhou, Shenzhen, Haikou	36.6%	27.7%	25.6%
Southwest	8.9%	1.6%	Chengdu, Kumming, Chongqing	3.3%	13.5%	10.4%
Northeast	4.7%	1.4%	Xian	5.7%	5.4%	3.1%
Northwest	10%	5.7%	Dalian, Shenyang	5.5%	6.2%	4.2%

Source: Air Cargo in Mainland China and Hong Kong

After the signing of direct air policy, Taiwanese airlines and carriers are only able to touch Mainland China international airport but airport that is opened for Cross Strait activities. Otherwise, airlines and carriers need to find some Chinese airlines or carriers to help them

connect with others regions inside Mainland China. Thus, it is common to observed cooperation agreement as alliance and code sharing between some Mainland China and Taiwan airlines. This kind of cooperation agreements helps airlines to find more opportunities, route connection, more market share and productivity to their business.

Table 4. Air cargo concentration in Mainland China

Air Cargo Concentration	
Market Share	**Major Airport**
Around 20%	Beijing and Shanghai
Around 10%	Guangzhou
Above 3%	Shenzhen, Chengdu, Kunming
Below 3%	the rest of the airport

Source: Air Cargo in Mainland China and Hong Kong

Half of Mainland China air cargo throughput are making by Beijing, Shanghai and Guangzhou. This is because these airport are located at the center of the most important economic and industrial zones in China where Beijing serve Beijing/Tianjin economic development zone, Shanghai the Yangtze River Delta, and Guangzhou the Pearl River Delta.

Information Flow

On Mainland China, electronic customs pre-declaration using EDI is required by the Customs Bureau in major airport cities. Air cargo usually uses EPORT and RosettaNet in their cargo trading process. The Eport is an information system jointly developed by Customs General Administration of China, Ministry of Communication, Ministry of Public Security, Ministry of Foreign Trade and Economic Cooperation, and others. The Eport aims is to achieve a paperless custom declaration and clearance and for future applications are intended to cover a full range of customs services as well as electronic payment for tariffs and fees (Anming Zhang et al, 2004).

On Mainland China, there is a limited use of internet based information system services provided by agents of the air cargo for their customer. The use of electronic trading system for procurement is not yet common practice in China. The communication between airlines and forwarders are typically done through fax and phone calls. For the cargo

management, many airlines in Beijing and Shanghai subscribe to IT services from SITA's Super cargo system. Through the SITA system, airline can receive master waybills and manifest from its overseas sales offices prior to flight arrival. Then, the information sent to customs through EDI for pre-declaration. In contrast, forwarder internal management is commonly computerized and inter-connected. Their related department and operation worldwide are globally connected for coordination. Most of them provide shipment tracking and tracing capabilities through internet.

Alliance and Code Sharing

Airlines alliance is a cooperation team between airlines. Cross Strait direct flight policy allows airlines from both sides to find partner who can help them with some route and business market.

Table 5. Airlines Codeshare and Alliance Groups I

Airline	Codeshare	Route
China Airlines	Mandarin Airlines	
China Airlines, Mandarin Airlines	China Eastern Airlines, China Southern Airlines, Xiamen Airlines, China Eastern Airlines	
Eva Airway	Uni Airlines, Air China, Shenzhen Airlines	
Uni Airlines	Air China, Eva Air, Hainan Airlines, Shandong Airlines, Shenzhen Airlines, Xiamen Airlines	
TransAsia Airlines	Shenzhen Airline	Wuxi-Taipei
TransAsia Airlines	Xiamen Airlines	Kaohsiung-Fuzhou Kaohsiung-Xiamen Taichung-Xiamen SongShan-Fuzhou

Source: Alliance Groups-Wikipedia

For example, China Airlines and China Eastern cooperate in order to enter Mainland China and Taiwan market. Ways airlines cooperate are as follow:

1. The cooperation between China and Taiwan airlines is to help the connection of flight in the domestic market inside Mainland China. For example, China airlines flight to an

international airport at China, but due to Mainland China domestic flight regulation that only their national carrier can serve it. Then, the cooperation allows China Eastern Airlines to make the domestic and other international flight inside Mainland China or vice versa.

2. Cooperation can help airlines make connection to others destination.

3. Another innovation in the cooperation it is the issues of their ticket. A very important step in airlines cooperation is that they can issue one ticket of different company. By this way, they are improving their services quality.

4. Cooperation can help airlines reduce cost due to that airlines can share check desk stand and VIP room at airport. By this way, airlines can minimize some cost.

Table 6. Airlines Codeshare and Alliance Groups II

Alliance Group	Mainland China	Taiwan
Sky team	China Eastern Airlines China Southern Airlines Shanghai Airlines Xiamen Airlines still in negotiation their inclusion.	China Airlines Mandarin Airlines
Star Alliance	Air China Shenzhen Airlines still in negotiation their inclusion.	Eva Airways still in negotiation their inclusion.
One World		

Source: Alliance Groups-Wikipedia

In short, the planning of airlines network is a very sensitive issues that each airlines companies need to elaborate according to their business goal, objective and strategy they want to target. There are many factors that airlines and carriers take in consideration when planning the aircraft utilization, schedules, strategies and routes. The decision for carriers of choosing their air network it is essential for all their future economic and strategic development. Emphasizing again that carriers would serves only route when a market demand is there or for strategy reason.

2.1.2. Efficiency Effect on Transportation's User

Transportation is required in the whole production procedures, from manufacturing to delivery to the final consumers and returns. Only a good coordination between each

component would bring the benefits to a maximum (Yung-yu Tseng, 2005). The operation of transportation determines the efficiency of moving products. Improving in techniques and management principle can enhances the moving load, delivery speed, services quality, operation cost, usage of facilities and energy saving.

Yung-yu Tseng et al state that without well developed transportation system, logistics could not bring its advantages into full play. And besides, having a good transportation system in logistics activities could provide better logistics efficiency, reduce operational cost, and promote service quality. However, enhancing transportation system needs the help and effort from both public and private sectors. As transportation system is the most important economic activity among the components of business logistics system. Yung-yu Tseng et al state that around two thirds of the expenses of enterprise logistics cost is spent on transportation. Transportation cost is the highest cost of the logistic cost as shown in Figure 10. Cost ratio of Logistics.

Figure 10. Cost ratio of Logistics
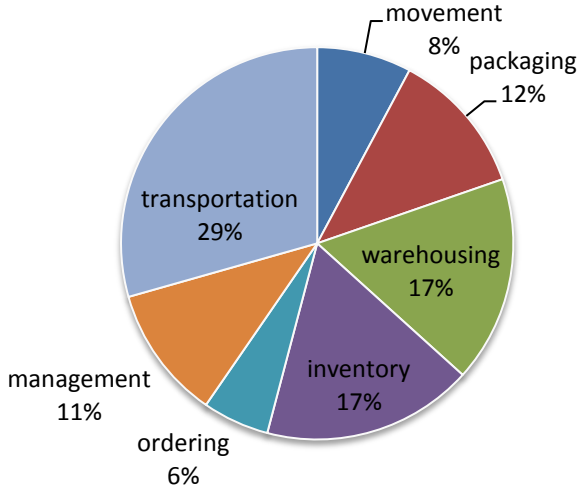
Source: The Role of Transportation in Logistic Chain

ICF Consulting states that enhancing in freight carriage can be expected to have important economic effect on manufacturing and goods distribution. As transportation policy allows freight transportation to reorganize their industries, carrier can get lower their operational cost and/or can offer better services and/or both. This situation can bring positive

effect to transportation industries by engaging more manufacture and good distribution industries.

By reducing the cost of good carriage, manufacturing, factories, and distribution point can serve a wider market. On the other hand, by reducing cost of freight transportation can change factory draw supplies from a wider area market. This reduction on freight transportation cost cans potential gain in cost and quality material and part supplying factories. Another benefit gained by transportation system, reduction in transit time and increased in their schedule reliability can attract manufacturing due that their goods can spend less time moving from origin to destination, this would help extends the reach of factory and warehouse.

Further, transportation cost reduction can influence firms. Firm like high tech industries can response with reorganization of its logistics performance. High tech industries perform change such as using fewer warehouses, willing to move good longer distances, carrying less inventory for a given level of sales and/or spend more in transportation cost, but gain welfare from logistics improvement. Additional benefits that firm may gain after reorganization effect could be improved products, new products or some other change. However, there are some others effect such as increase regional employment, rate of growth, and others.

Figure 11. Shipper reaction to transportation cost
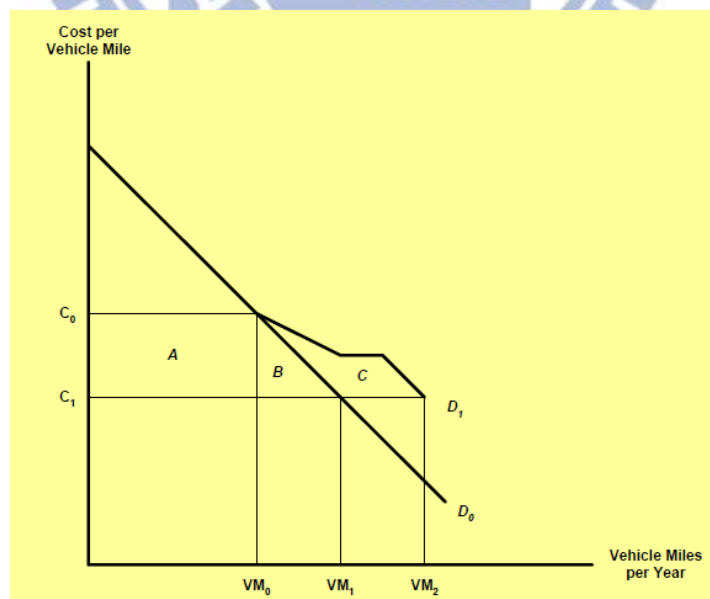
Source: Economic Effects of Transportation: The Freight Story

Studies of the Freight Management and Operation (USA) have determined that enhancing freight transportation system can spread reduction in cost and gains in productivity through all the economic sectors that produce or distribute goods. In short, improvement in freight carriage can be truly valuable contribution to the efficiency of the whole economy.

ICF Consulting has developed study about how an improvement in transportation system influence of shipper demand for freight transportation by suing benefit and cost analysis. They state that the shipper's demand curve for freight transportation can takes two forms, D0 and D1. In the demand curve, D0 shows a shipper's demand for freight transportation before an improvement to the freight system. Then, D1 shows the change in demand that follows the improvement.

In their study, they suggested that the shipper's reaction to the cost reduction can be thought of as occurring in three phases.

1. In the very short run, the shipper makes no response and continues to buy the same number of vehicle miles of freight, VM0. The benefit to the shipper is the area A, the cost reduction with the existing volume of freight.

2. In the next phase of response, the shipper takes advantage of the lower cost and buys more freight movement, VM1. This adds the area B to the benefit. But this still reflects the shipper's original demand curve, D0. The shipper has not made any changes in the firm's basic logistics.

3. When managers consider the cost reduction and believe that freight movement is worth to the firm then would make changes in their logistics. This is when the shipper's demand for transportation would change, and there would be the new freight transportation demand curve, D1. The additional benefit from the reorganization is area C, the area between the old and new demand curves.

ICF Consulting states that the full benefit of freight improvement is the sum of areas A, B, and C as shown in Figure N°11. Shipper reaction to transportation cost.

Case of Taiwan Cross Strait

The flexibility of connecting Mainland China and Taiwan has brought many economic benefits to airlines, carrier, shippers and others industries that in one ways or another they have been affected with the trade and economy growth in the region. Another benefit of reducing air restriction is that Taiwanese industries take advantage of Mainland China market.

As market size of its counterpart is the world's most-populous country where its population of over 1.3 billion and it is the world's second-largest country by land area.[10] Hence, the magnitude of the market size makes it more attractive for air carrier companies that want to join more market. The Cross Strait direct flight policy gave carrier the possibility to enter the market and compete for it. The direct air policy allows the mobility of Mainland China and Taiwan people between the Taiwan Strait. Certainly, the accessibility has increased the tourism and sightseeing destination between both sides. However, Taiwan carriers are looking farther than only have access to Mainland China. Carriers are looking forward for destination like Europe route and America route.

Besides the market size and population, there are many other benefits that Taiwanese business and others foreigner business can gain by targeting Mainland China. Benefits that foreigner business are looking in Mainland China are their lower labor cost, raw material, low price supplier and many others that can help their industries increase higher profitability. These factors contribute foreign investment firm in Mainland China. A lot of manufacturing relocated their firm to China. The labor contribution of Mainland China is more related to assemble activity than providing technology advantage. Subsequently, assembled high-tech products made an important contribution to Mainland China high tech exports.

China was not a major player in the global market of high-tech products because their contribution is on resource and labor intensive products. Based on statistic, the 83% of China's high-tech exports were attributed to foreign invested firms, in particular Taiwanese owned companies. Taiwan-IT companies have relocated 95 % of their production/assembly capacity into and transferred mainland China. This is the reason that Mainland China has so high export percentage in high tech products.

Therefore, the statistics presented by the Chinese government said that China has turned into a high-tech export giant and its high-tech exports reached US$377 billion, about 31% of China's total exports in 2009 (Xing, 2011). There are literatures that suggest that Mainland China high tech export has little to do with technologies advancement. And suggest that Mainland China only provide assembly labor for IT products.

Studies state that 82% was processed/assembled high-tech products, mainly made of imported parts and components from industrialized economies, such as Germany, Japan, Korea, Taiwan and the US. Then, China contribute with the assembled of high-tech products

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[10] Wikipedia

therefore their intellectual properties contribution is very small. More and more foreign firms took advantage of China's cheap labor by relocating labor intensive segments of production chains to China and utilizing China as an export platform.

Studies stated that Mainland China's high-tech exports actually became more labor intensive rather than capital /technology intensive. Since key parts and components in assembled high-tech products are imported and screwing these intermediate inputs into finished products requires only low skill workers. Accordingly, the contribution of Chinese workers to these products is not advanced technology, but labor.

China's openness to FDI Foreign direct investment and its rich endowment in labor constantly attract Multinational enterprise to relocate their product capacities, outsource labor intensive components to China and integrate China into their global production networks, thus boosting the production of high-tech goods (Xing, 2011). Foreign invested firms have been driving the rapid growth and producing more than half of China's exports.

Figure 12. Foreign invested firm's contribution to China's high tech export
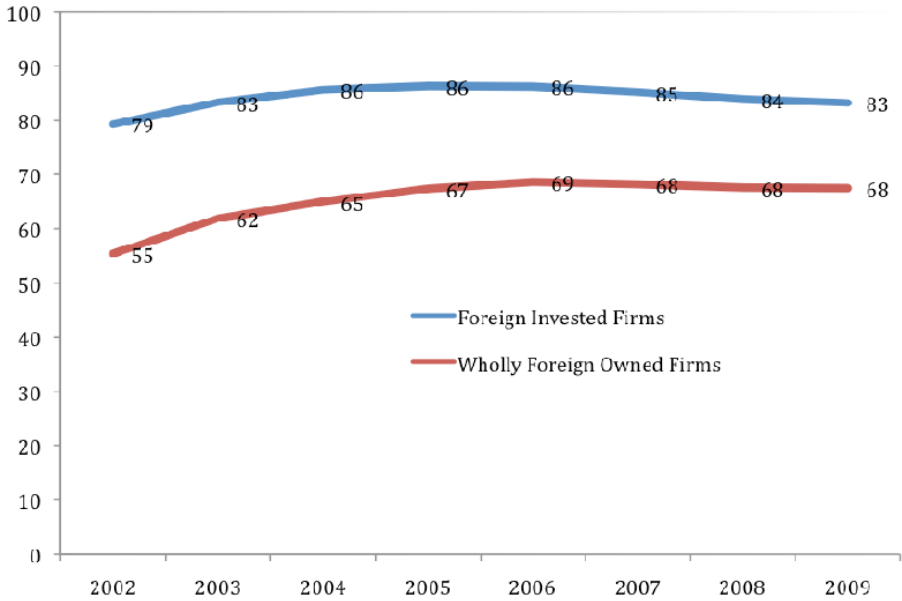
Source: China's High tech Export: Myth or Reality

In Mainland China, most of the manufacturing investment manipulates the following high-tech products categories: computers and telecommunications, life science technologies, electronics, computer-integrated manufacturing, aerospace, optical-electronics, biotechnology, materials, and others.

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Table 7. High Tech trade by Technologies in Mainland China

Technologies	Exports		Imports		Trade Balance
	Value (US$billion)	Share(%)	Value (US$billion)	Share(%)	Value (US$billion)
Computer and Telecommunications	282.5	74.9	73.6	23.7	208.9
Life Science technologies	11.1	2.9	9.5	3.1	1.6
Electronics	51.1	13.6	148.5	47.9	-97.4
Computer-integrated manufacturing	5.1	1.4	19.7	6.4	-14.6
Aerospace	2.7	0.7	14.0	4.5	-11.4
Optoelectronics	20.9	5.6	38.5	12.4	-17.6
Biotechnology	0.3	0.1	0.4	0.1	-0.1
Materials	3.0	0.8	5.1	1.6	-2.1
Others	0.4	0.1	0.6	0.2	-0.2
Total	376.9	100	309.9	100	67.1

Source: China's High tech Export: Myth or Reality

Taiwanese companies have become the largest original equipment manufacturers and original design manufacturers for leading international IT firms such as IBM, DELL, Intel, SONY, etc. Taiwan has developed technology and production capacities in semiconductor and information technology industry since 1980.

As shown in table 8. Fact of Taiwanese owned IT Companies at Mainland China, most of the high tech products are sold in markets outside of Taiwan and mainland China. Such as, 95% of digital cameras, 92% of laptops, 83% of desktop, 74% of motherboard, 80% LCD monitor and 89% of servers are exported to overseas market.

Many foreigner businesses established their manufactory and factories center at Jinhai area. Jinhai area is all the territory located near the Mainland China coast which mean that is located in the eastern side of Mainland China. The Jinhai area is serving by some airport like Shanghai, Guangzhou, Shenzhen and among others. However, because of the development and concentration of industries at the eastern side of China, the labor cost at the Jinhai area is higher than before. Consequently, manufacturer and factories strategic is moving their center to the western side of China where the cost is still low. As result of manufacturer and factories location, airlines and carriers would expand their services in order to get the new market

demand. As foreign investment relocating the production of their products into mainland China immediately increased the China's output in IT products.

Table 8. Fact of Taiwanese owned IT Companies at Mainland China

	Laptop PC	Desktop PC	Motherboard	LCD monitor for PC	Servers	Digital Camera
Rank in Market share	1	2	1	1	2	2
Annual Output (1,000 unit)	90,165	46,055	149,097	117,539	2,950	49,896
Global Market Share (%)	92.8	32.6	97.2	70.2	35.2	42.2
*Exports as (%) of output	91.5	82.8	73.7	80.5	89.4	95

Source: China's High tech Export: Myth or Reality

Table 9. Shares of major IT products by Taiwan and made in Mainland China

	Laptop PC	Desk Top PC	Motherboard	Server	LCD monitor for PC	Digital camera
2003	54.3	51.7	73.9	21.3	79.1	89.2
2004	77.8	54.1	86.2	25	84.6	98
2005	92.8	57.5	91.6	42.2	88.7	98.5
2006	96.9	63.9	94	53.4	90.6	99
2007	97.8	71.7	96.4	57.5	91.5	98

Source: China's High tech Export: Myth or Reality

At the table 9. Shares of major IT products by Taiwan and made in Mainland China represent the percentage of high tech products made by Taiwan but produced in Mainland China. As shown in the table N°1, on 2007, 98% of digital cameras were made by Taiwan were produced in its mainland China factories; 97.8% of laptop computers, 72% desktop, 96% motherboard, 57% of servers and close to 92% of LCD monitors for PC were made by Taiwan were produced in its mainland China factories.

According to Oliver Richard, the price and flight frequency can influence in customer decisions. Therefore, consumers would value the convenience of a flight schedule with multiple departure times, because they are more able to find a flight that is closer to their desired departure time. Qualities that shippers and passengers appreciate are travel time, waiting time, reliability, schedule frequency, connectivity and saving cost. The airline

consumer significantly values the convenience of a flight schedule with multiple departure times (Oliver Richard, 2002). Allow airlines to compete strategically and improve their services quality (Y.2 Y. Lau et al. 2012).Subsequently, carriers that can supply what customer want and need gain more market.

2.1.3. Efficiency Effect on Government Administrative cost and subsidies

A clear benefit from airlines deregulation is the reduction of administrative cost to the federal government for salaries and office space incurred under regulation.

Also, there has substantial decline in the cost of federal subsidized air services. Under regulation the government provided and continues to provide under deregulation, subsidies for essential air services, primarily to small communities.

Case of Taiwan Cross Strait

However, the political issues between Mainland China and Taiwan don't allow minimizing some administrative expenditure. [11] Taiwan government increased their administrative cost by the creation of office for special Cross Strait relation, the Association for Relations across the Taiwan Strait (ARATS). On the other hand, Mainland China government increased creates a special office for Cross Strait relation purpose, the Straits Exchange Foundation (SEF).

And regarding subsidies, several carriers' state that Taiwan government doesn't provided for airlines industries.

2.1.4. Impact Studies: Generative and Distributional Effect

When government decided to release a public policy, make investment in transportation or infrastructure or allow improvement in transportation, one of the conditions mentioned or all of them can affect both economic and non economic factor in the areas proximate to the economic activities and even to those at more distant. The improvements of transportation system that influence society are complex and often indirect. The impact can be differentiating from short, medium and long run.

Preview studies suggested that any improvement in transportation system can cause productivity and national income growth. Therefore, the economic development is the result of

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[11] Chih-Ching Chang et al, Developing direct shipping across the Taiwan Straits, 2005.

improved access to labor pool, investment in new or expanded enterprise or access to larger markets. However, productivity is difficult to estimate due that changes occur within the production process. Studies stated that enhancing transportation system is a way to stimulate the productivity of labor and private capital. Steven Morrison et al state that airline deregulation has resulted in substantial overall efficiency gain. Specify group losses welfare with deregulation. Distributional consequence of airlines deregulation can affect the industry labor force, users from small communities, user in specific geographical region and on different routes.

Industry Force Labor

The effect of deregulation on airlines labor is not obvious a priori. However, deregulation give airlines more welfare gain, labor power also want to share that revenue. Airlines unions have thus gained bargaining power by making carriers more vulnerable to strikes particularly because other carriers are free to enter their routes. On the other hand, other effect of deregulation on labor could when one carrier undercut other carrier's labor cost, giving its own carrier an advantage in the product market. Morrison et al state that the effect of deregulation on labor is uncertain.

Improvement of transportation system offer more market opportunities not only to carrier but also to shipper. In term of labor pool, enterprises have larger employment pool from with to draw. Then, competition can help them to reduce wages levels. Further, larger pool can help enterprise find more match between skills and jobs. Consequence of better transportation system, worker and business men can move easily to employment opportunities. Freight Management and Operation state that enhancing transportation and improving access to market can affect the demographic pattern and production cost of a enterprise.

Services to small communities

A concern about deregulation is that the quality of service to small communities would deteriorate once airlines were no longer regulated. Population worries about if deregulation would affect the availability of service to small communities. One effect of deregulation is that can enable carriers to withdraw more easily from market that they no longer wish to serve. However, that market can be guaranteed continued air service through subsidies to carrier if necessary. Morrison et al state that deregulation is not responsible for losses in service to small

communities. It appears that these losses are largely explained by the increase in fuel prices and by the cyclical macroeconomic conditions.

Case of Taiwan Cross Strait

Government regulates the route and communities that Cross Strait airlines can serve. Airlines that serve Cross Strait are under government regulation about the market section they want and have to serve. Airlines that want to supply a high demand market (hot market) government would suggest airlines to supply also a low demand market (cold market).

Geographical effect

Morrison et al find out that deregulation does not appear to have had a differential impact either by region or by type of route. Evidently, under deregulation carrier pricing practice and hub and spoke operations do not cause gain or losses to be concentrated in particular regions or on particular types of route. However, there are others industries such as manufacturing or good distributor that can be stimulated by the reduction of transportation cost or the easier access to material or market. This can stimulate a business location decision. The change in geographic can affect the income distribution and personal life of the population. Geneveive Giuliano state that having better transportation system can make enterprise firm shift from one area to another within the region. In addition, this can stimulate out migration of industry from more remote areas. According to some studies, Taiwan government is looking turn Taiwan into Asia Pacific operations center. Thereby the government is working hard to attract foreign investment and Taiwanese investment in the area Taiwan Trade Free Zone and Science Park as shown in the following table and figure.

Table 10. Taiwan Trade Free Zone

Taiwan Trade Free Zone
1. Taipei Trade Free Zone
2. Suao Trade Free Zone
3. Taichung Trade Free Zone
4. Kaohsiung Trade Free Zone
5. Keelung Trade Free Zone

Source: Taiwan Trade Free Zone website

Figure 13. Taiwan Science Park

Source: National Science Council

So studies shows that deregulation can induce existing enterprises to relocate and take advantage of new conditions. The relocation decision can influence the competitiveness and scale operations of enterprise. The highest competitiveness, the higher achievement in productivity an enterprise can obtain. Thus, this can contribute positively the national economy.

Public transportation policy offers more than opportunity for carriers or enterprise but also offer more market opportunities for population. As market or access opportunity increased, can make population and economic activities change geographically. The change can affect the income distribution and personal life style for both population and economic activities industries. Therefore, many studies suggested that there is a relationship between transportation and land use. [12] In the past, manufacturing used to located nearby the cities or at the cities due to the large labor pool allocate in the area. However, there are serious implications having activities inside the cities. Environment and quality of life of resident or people living nearby economic activities would be affecting due to their activities.

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[12] Genevieve Guiliano, New Directions for Understanding Transportation and Land Use, 1988.

Figure 14. Suburban Logistics

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Source: The Geography of Transportation System(1998)

Study such as City Logistics and Suburban Logistics that try to optimizing the logistics and transport activities by private companies in urban areas while considering the traffic environment, the traffic congestion and energy consumption.[13] Suburbanization has impacted a large share of the global urban landscape and characterizes a specific context in which freight distribution takes place. Although suburban is functionally integrated to the central city, it is also a distinct space with its own consumption patterns. In short, change in transportation improvement or public policies could affect the land use, business decision and population.

Trade Balance

Past literature, many studies examined and estimated that cost reduction on transportation could enhance the productivity and competitively of enterprise and region economy. Then, they found that increasing transportation reliability and creating more accessibility to market can enhance productivity and therefore improve competitiveness. This would provoke a balance of trade in the region. This means that can increase foreign investment, reduce capital outflow or find exchange stability improvement.

The government in Taiwan is working to turn the region into Asia-Pacific regional operation center. They are offering enterprise to have advantage of transmission and more

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[13] Jean Paul Rodrigue et al, The Geography of Transportation System, City Logistic, 1998.

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[13] Jean Paul Rodrigue et al, The Geography of Transportation System, City Logistic, 1998.

value added services for their supply chain.[14] As most of the Taiwanese manufacturing at Mainland China is located there due to lower labor, the government wants to provide better logistic by enhancing air transportation and providing better benefit in their trade free zones.[15]

Qualities of life

Another effect that development of better transportation system can cause is the change in personal welfare. The quality of life would be affected in one way or another Expansion of mobility and better access to market contribute to have better quality of life. This means that passenger and cargo would spend less time taken on trip. Studies suggested that changes like business location place remain in the same place but attract labor from others regions or vice versa can happen. Therefore, population can be able to stay in the same works without changing jobs
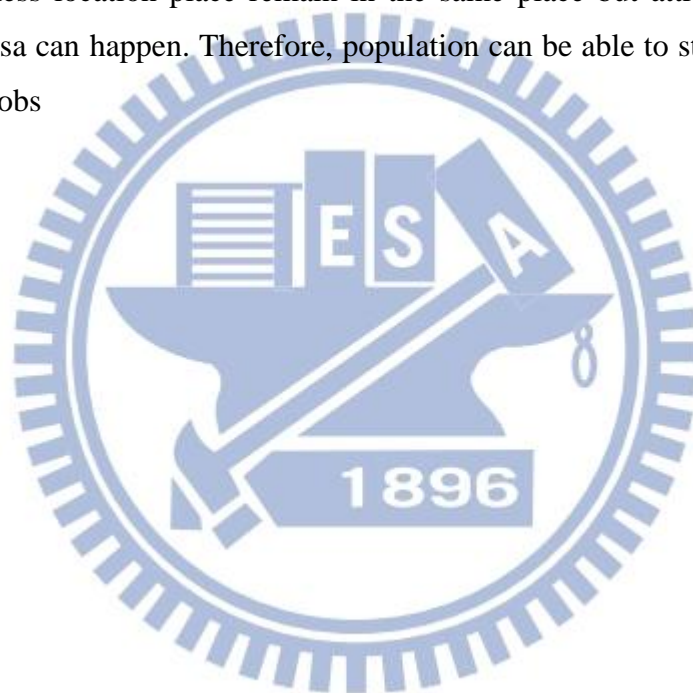
[14] Chaug-Ing Hsu, High Tech firms perception and demand for air cargo logistics services, Journal of the Eastern Asia Society for Transportation Studies, volume 6, page 2868-2880, 2005
[15] Yuqing Xing, China's High tech Exports: Myth and Reality, GRIPS Discussion Paper 11-05, June 2011.

2.2. Asia-Pacific Operational Center

As many studies and statistic indicators show that the Asia-Pacific region will become the new center of gravity for global economic activities. Lots of enterprises hope to increase their investment in the region in order to play a role in the rapidly-growing Eastern Asian market. Chaug-Ing Hsu et al state that Taiwan government works hard for being Asia-Pacific regional operation center, thereby offering the firms to have advantages of transmission and more value-added services in the supply chain.[16]

Hence Taiwan government puts more and more emphasis on the development of the high-tech industry to keep the advantageous status in the market. Besides, the government encourages developing innovation technique and inspires private and foreign investments. Many studies have shown that high tech products delivery by airlines is more efficient than by maritime and therefore the importance of air cargo. Some studies have discussed that the importance of the air cargo was resulted from an increasing competitive regional and global market (Chaug-Ing Hsu, 2005).

On the other hand, global market is essential for the high-tech industry to do the economies of scale. The need of economies scale is due to enormous investment done in product research, product development and product production by high tech industry. Thus, it is important to provide logistics services for high-tech firms so as to immediately, safely and conveniently deliver their goods to worldwide consumers. The prosperous high-tech industry development in Taiwan has induced the change of the industry structure along the west corridor of Taiwan.

Additionally, the Civil Aeronautics Administration of Ministry of Transportation and Communications is also helping to promote the Project for Developing Taiwan as an Asia-Pacific Regional Operations Center and Global Logistics Center. They have selected 450, 200 m² of land in the Specific District Plan for Taoyuan Cargo Park and Passenger Transit Park to promote the construction and development of an aviation city for Taoyuan International Airport.

Taiwan government is looking for private participation in their project. The plan of the government will be invest to build the basic public facilities, and encourage private organizations to invest operation warehouse and value-added logistics facilities, etc. The idea

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[16] Chaug-Ing Hsu et al, High Tech Firm's Perception and Demand for Air Cargo Logistics Services, vol. 6, pp 2868-288, 2005.

is develop a place where goods, business, personnel, capital and information can be accessed quickly and conveniently, in order to attract international and local enterprises to regard Taiwan as the base of the international market.[17]

2.2.1. Free Zone Trade

The Free Zone Trade are special zones that are "inside national territory but outside customs" that try to offer a good environment for transnational business operations by lowering barriers to the flow of goods, commerce and people. The Free Zone Trade tries to meet all the business needs for supply-chain management thereby strengthens users' competitive advantage. In the table 11. Why choose Taiwan Free Zone, there is a comparison between the benefit that Mainland China free zone trade and Taiwan free zone trade can offer to enterprise and firm.

Table 11. Why choose Taiwan Free Zone

Region	Aims	Business Tax	Operating Authority	Businesses	Customs Clearance	Circulation of Commodities	Incentives	Business Solicitation Approaches
Taiwan	Global operational management mode. Enhancing national competiveness	17%	Private, single window	Import, export, re-export trade, storage, labeling, dismounting, re-packaging, assembling, testing, classification, and in-depth processing and manufacturing	Report	Free access within the FTZ, self-management by manufacturers	Provided with incentives	Responsible by dedicated units
China	The center of commodities gathering and resources distribution in the Asia Pacific region	25%	Local government	Processing, manufacturing, and international trade	Customs declaration	Self-management, bonded, labeling, assembling	Consistent nationwide incentives, and local customized incentives	

Source: Based on "Free Trade Zone Planning and the Research on Practices of the Relevant Countries", Council for Economic Planning and Development.

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[17] http://www.taoyuan-airport.com/english/Publish.jsp?cnid=856

Even though, Taiwan Trade Free Zone offers good benefit for investor as can appreciated in table 11. Why choose Taiwan Free Zone. Based on statistic of Mainland China government 83% of all the foreign investment firm are from Taiwan. In Table 12. Taiwan investment in Mainland China by Area (1991-2011) and Table 14. Taiwan investment in Mainland China by Industries (1991-2011) showed Taiwan investment in Mainland China by area and industries.

Table 12. Taiwan investment in Mainland China by Area (1991-2011)

By Area	Case	Amount	Percentage of Amount
Kiangsu	6,358	37,608.21	33.92
Canton	12,495	24,155.55	21.79
Shanghai	5,467	16,276.80	14.68
Fukien	5,455	7,513.61	6.78
Chekiang	2,068	7,103.09	6.41
Tientsin	918	2,044.03	1.84
Beijing	1,208	1,831.30	1.65
Shantung	992	2,386.54	2.15
Chongqing	243	1,692.53	1.53
Hupei	551	1,268.09	1.14
Others	3,754	8,981.35	8.1
Total	39,509	110,861.10	100

Source: Civil Aeronautical Administration (1991-2011)

As shown in table 12. Taiwan investment in Mainland China by Area (1991-2011), Kiangsu or Jiangsu is home of the world's leading exporters of electronic equipment, chemicals and textiles. And as statistic shows it has also been China's largest recipient of foreign direct investment since 2006. In the area of Kiangsu, it is possible to find the following Economic and Technological Development Zones such as Changzhou National Hi-Tech District, Kunshan Economic and Technological Development Zone, Nanjing Baixia Hi-Tech Industrial Zone, Nanjing Economic and Technological Development Zone, Nanjing New & High-Tech Industry Development Zone, Nantong Economic & Technological Development Area, Lianyungang Economic & Technological Development Zone, Suzhou Industrial Park, Suzhou Hi-Tech Industrial Development Zone, Wuxi New District, Yixing Economic Development Zone, Zhangjiagang Free Trade Zone and Zhangjiagang Bonded Logistics Park and among others.

Based on the statistic of the Civil Aeronautical Administration, approximately 40% of Taiwan investment firm are from electronic and computer related industries.

Table 13. Taiwan investment in Mainland China by Industries (1991-2011)

By Industries	Case	Amount	Percentage of Amount
Electronic Parts and Components Manufacturing	2,640	22,363.12	20.17
Computers, Electronic and Optical Products Manufacturing	2,737	15,631.20	14.1
Electrical Equipment Manufacturing	3,048	8,861.60	7.99
Fabricated Metal Products Manufacturing	2,586	5,647.16	5.09
Plastic Products Manufacturing	2,347	4,951.76	4.47
Chemical Material Manufacturing	812	4,404.55	3.97
Machinery and Equipment Manufacturing	1,986	4,606.69	4.16
Non-metallic Mineral Products Manufacturing	1,578	4,578.02	4.13
Wholesale and Retail Trade	2,436	5,599.97	5.05
Basic Metal Manufacturing	654	2,769.93	2.5
Food Manufacturing	2,333	2,680.94	2.42
Textiles Mills	1,108	2,141.31	1.93
Others	15,244	26,624.87	24.02
Total	39,509	110,861.10	100

Source: Civil Aeronautical Administration (1991-2011)

2.2.2. Taiwan Science Park

Taiwan Science Park is an industrial park established by the government. Inspired by Silicon Valley in the United States, where is a clustering of many technology industries; home to many of the world's largest technology corporations. There are three core parks: Hsinchu Science Park, Central Taiwan Science Park and Southern Taiwan Science Park, each having its own satellite industrial clusters.[18] Hsinchu Science Park (HSP) is one of the world's most significant areas for semiconductor manufacturing. More than 400 high-tech companies mainly involved in the semiconductor, computer, telecommunication, and optoelectronics industries. Beside Hsinchu Science Park, Taiwan has the Southern Taiwan Science Park (STSP) that aim to cluster and establishing an optoelectronics technology hub in southern Taiwan.

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[18] http://www.taiwan.gov.tw/ct.asp?xItem=27510&ctNode=1906&mp=1001

A third Science Park was developed among Taiwan's regions. This industrial park was created to maintain the balance between Hsinchu Science Park, and Southern Taiwan Science Park. Then, Central Taiwan Science Park (CTSP) was established in 2003 and centered on the development of optoelectronics, ICs, precision machinery and biotechnology. Since then, the CTSP has captured latecomer advantages, including adopting the most up-to-date technologies and new management models, posting better performances than its predecessors in revenue growth, development and operating efficiency.

Figure 15. Taiwan Science Park Revenue
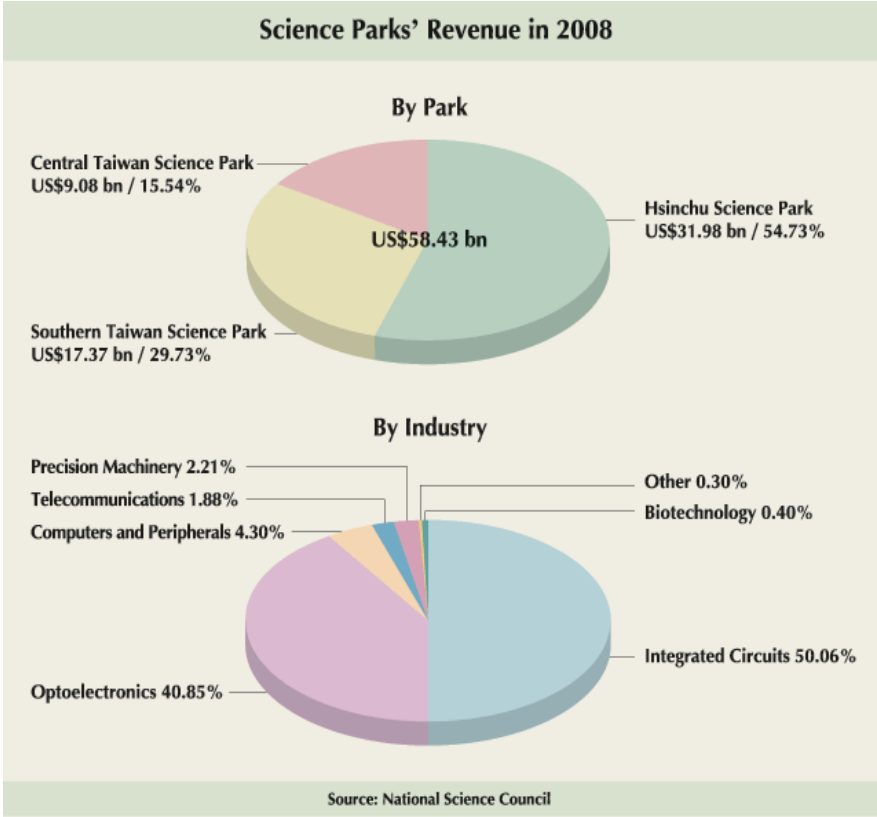
As shown in figure 15, National Science Council reveals that Hsinchu Science Park is the Science Park that gained more revenue. According to 2008 statistics, Hsinchu Science Park gained US$31.98 bn, Southern Taiwan Science Park gained US$17.37bn and Central Taiwan Science Park gained US$9.08bn. In addition, according to National Science Council data, industries inside those Science Park that gained more revenue are Integrated Circuits, Optoelectronics, Computers and Peripherals, Precision machinery and among others.

Hsinchu Science Park is one the Science Park that has the largest employment rate until the opener of Central Taiwan Science Park. As shown at figure 16. Taiwan Hsinchu, South and Central Science Park employment, before 2004, the Science Park that has the largest employment rate was Hsinchu Science Park, followed by South Taiwan Science Park. However, with the opening of Central Taiwan Science Park, Hsinchu Science Park became the second largest Science Park with the highest employment rate.

Figure 16. Taiwan Hsinchu, South and Central Science Park employment
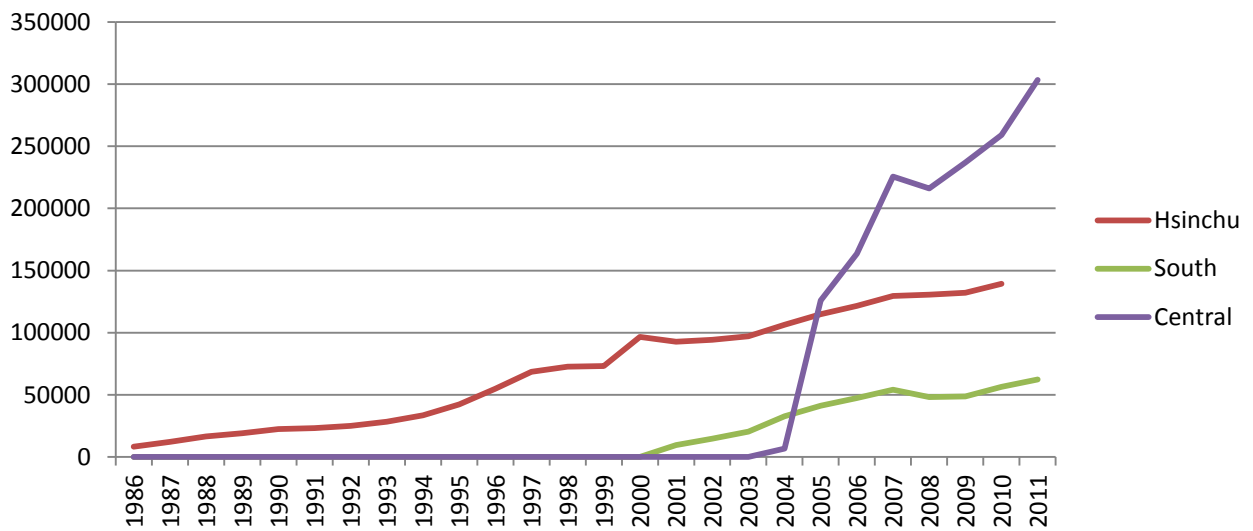
Source: Taiwan Science Park (1986-2011)

2.3. Regulatory Policy and Carrier Operations

Airlines industries had been control by a lot of regulation policies. Some regulation tries to protect national industries from threat and competition but sometime entry restriction is due to political conflict. Some regulation governing airlines are fares, market entry and exit, capacity, service quality, among others. This means that carriers' behavior is significantly influenced by Civil Aeronautical regulatory policies (Steven Morrison et al). Regulation limited the flexibility of fares, and entry into market.

One reason to accelerate the deregulation is the development of hub and spoke route network, which feed traveler and cargo user by spoke routes into a major airport called HUB from which they can take connecting flight to their destinations.[19] The criterion for adopting a hub and spoke route structure is based on the profit maximization behavior. The cost saving of this kind of network structure is result when economies of aircraft size are greater than the cost of rerouting traffic.

Even before deregulation, airlines employed some type of hub and spoke network. But although deregulation did not lead to the development of such operations and was not even necessary for their continued growth, deregulation can accelerated their use. In short, by eliminating entry restriction, deregulation gave carriers increased freedom and flexibility to restructure their network into effectives hub and spoke system. In the competitive environment encouraged by deregulation, the development of a hub and spoke route system has become an essential marketing tool.

Dennis Carlton et al state that passengers prefer single carrier services over having to change airlines in their midjourney. Because most city pair market are not large enough to support frequent direct service, carriers have developed hub and spoke networks to increase their ability to offer single carrier service to connecting passengers.

Hub and spoke network have also been used by carriers to protect and increase their market. An airline with a well developed hub and spoke network can discourage potential competitors by increasing the scale of entry required to compete effectively at its hub city.

Another benefit of establishing a hub and spoke network can allows airlines to have a more effective entrant into new markets.

Public policy play a key role in rising the benefits of deregulation and maybe more important, in preventing any erosion of grow already achieved by airlines. Although

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[19] Steven Morrison et al, The Economic Effects of Airlines Deregulation, page 6.

deregulation has not generated the optimal level of competition in every type of airline market, it has led to a considerable increase in airline competition with an attendant increase in welfare.

2.3.1. Cross Strait Policy

This research would focus on the effect of the Cross Strait Air Transportation Agreement signed between Mainland China and Taiwan. The Straits Exchange Foundation (SEF) and the Association for Relations across the Taiwan Strait (ARATS) were the entities that conduct the opening of Taiwan Strait direct air link negotiation. For the agreement, they discuss matter about the flight path, cross strait carriers, flight point, cross strait market demand, passenger and cargo flight, regular and charter flight, flight schedules, cooperation and communication way among cross strait parties, among others.

The purpose of the Cross Strait Air Transportation Agreement was to tries to help with the development of cross-strait economic and trade relations and ease contacts between both sides. Thus as in the direct flight agreement stated that if the demand for more cross strait activities is higher than the supply then according to the market demands more flight point and flight frequency would be opened.
Since the Cross Strait relation is a very sensitive topic, there were a lot of main concerns (Chang, 2006) among the population that worries about the socio-economic factors, maintain Taiwan national security and sovereign and the direct flight path between Mainland China and Taiwan (Mainland Affairs Council).

The Cross Strait agreement covers about future negotiation expansion for the introduction of more flight point at Mainland China; increase the frequency of flight across the strait, and among others issues that can enhance economy development. The Cross Strait Air Transportation Agreement also stated that expansion of more flight point, more flight frequency and/or improvement of direct flight agreement would be done according how the market demand evolves[20]. Therefore, the demand for more air service would be the one that can boost up more the air policy. The flexibility of connecting Mainland China and Taiwan has brought many economic benefits to airlines, carrier, shippers and others industries that with one ways or another they have been affected with the trade and economy growth in the region. The direct air policy allows the mobility of Mainland China and Taiwan people

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[20] Y.2 Y. Lau et al., The implications of the re-establishment of direct links across the Taiwan Strait on the aviation industries in Greater China, 2012.

between the strait. The accessibility for sure has increase the tourism and sightseeing destination between both sides. However, Taiwan carriers look farther than only have access to Mainland China. Carriers are looking forward to destination like Europe route and America route.

As mentioned at chapter 1, before the signing of the direct air link there was unusual charter flight only during special Chinese festival season. At that time, only 5 Mainland China airports and 1 airport at Taiwan were opened for cross strait charter flight. After the signing of the Cross Strait Air Transportation Agreement, 17 Mainland China airports and all the airports at Taiwan were opened for cross strait activities. Below in table 14, table shows the time and which flight points were opened to Cross Strait activities. As the cross strait market demand increase the opening of more airport point at Mainland China was negotiated in order to provide response to community and aviation industries. The second signing of air link agreement allowed the opening of 6 more new Mainland China airports.

Table 14. Cross Strait Air Transportation Agreement Stage

Flight Point	Mainland China	Taiwan
(before 2008) Airports opened	Beijing; Shanghai Pudong; Guangzhou; Xiamen; Nanjing	Taoyuan
(after 2008) Airports newly opened	Chengdu; Chongqing; Hangzhou; Dalian; Guilin; Shenzhen; Wuhan; Fuzhou; Qingdao; Changsha; Haikou; Kunming; Xi'an; Shenyang; Tianjin; Zhengzhou	Kaohsiung; Taichung; Taipei; Penghu; Hualien; Kinmen; Taitung
Airports newly opened	Hefei; Harbin; Nanchang; Guiyang; Ningbo; Jinan	Nil
Total	**27**	**8**

Source: The implications of the re-establishment of direct links across the Taiwan Strait on the aviation industries in Greater China (2012)

The Cross Strait direct flight agreement helps to boost the exchange of cargo. As shown in table 15. Cross Strait Cargo Traffic by Airlines, 6 Taiwanese airlines join the cargo traffic. Daily Air is one of the few that has not yet penetrated the Cross Strait direct flight business.

Table 15. Cross Strait Cargo Traffic by Airlines

Item	Cargo Traffic			
	Cargo tonnage	Cargo ton-kilometers	Cargo sale tonne-kilometers	Load factor (%)
China Airline	327,753	2,046,390,593	2,905,360,010	70.44
Mandarin Airline	10,330	2,983,765	11,217,003	26.60
Eva Air	300,917	1,820,450,559	2,212,835,961	82.27
Far Eastern Air Transport	121	-	-	-
TransAsia Airway	8,661	2,834,468	14,650,722	19.35
Uni Air	12,501	9,523,018	18,668,782	51.01
Daily Air	-	-	-	-
Accumulative Total	660,283	3,882,182,403	5,162,732,478	75.20

Source: Civil Aeronautics Administration (2012)

On 2012, according to Civil Aeronautics Administration, those airlines move a total of 600,283 tonnage of cargo where the airline that move more cargo is China Airline, Eva Air, Uni Air, Mandarin Ailine, TransAsia Airway, and Far Eatern Air Transportat; 327,753 tonnages, 300,917 tonnages, 12,501 tonnages, 10,330 tonnages, 8,661 tonnages, and 121 tonnages, respectively.

However in term of load factor, the airline that sale more cargo space s Eva Air, China Airline, Uni Air, Mandarin Airline, TransAsia Airway, and Far Eastern Air Transport; 82.27%, 70.44%, 51.01%, 26.60%, 19.35%, respectively.

However, after the signing of the Cross Strait Air Policy not only cargo traffic gains welfare also passenger flight join the benefits. As shown in figure 17. International passenger numbers and cross-Strait passenger numbers at Taiwanese airports, many tourist and business people are using the direct flight. The figure compares the number of international and cross strait passenger Taiwanese airport handle between 2009 and 2011.

Figure 17. International passenger numbers and cross-Strait passenger numbers at Taiwanese airports: Sep-2009 to Jul-2011
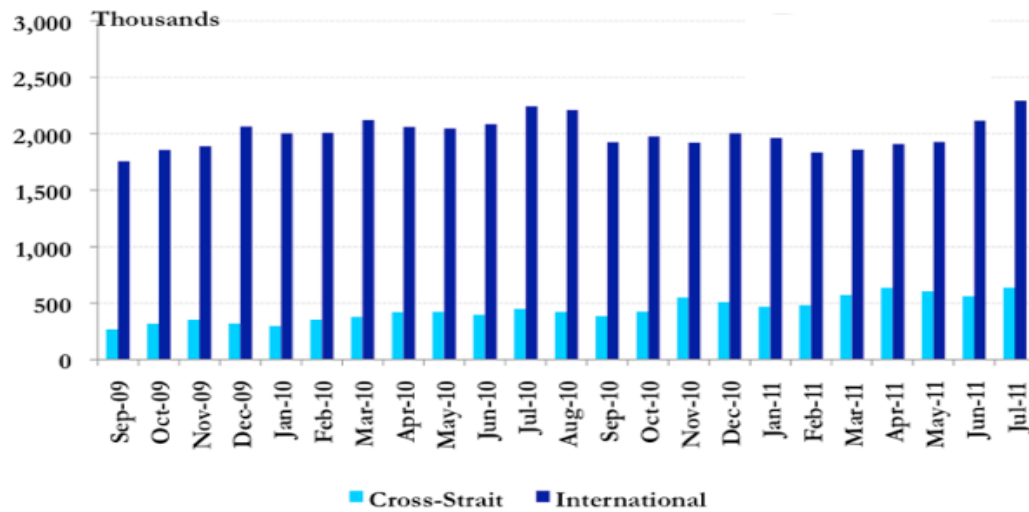
Table 16. Cross Strait market share between Taiwanese national airlines

Taiwan National Airlines	2010	2011
China Airlines	55	51.8
Eva Air	31.2	33.3
TransAsia Airway	6.2	
Mandarin Airlines	5.3	14.9
Uni Air	2.3	
Far Eastern Air	0	
Daily Air	0	0

As the theory of air liberalization suggest that without restriction between countries, airlines business would boost. A clear example that we have is with the opening of Taiwan Strait direct flight, aviation industries at Taiwan experiment new air services that connect Mainland China with Taiwan after more than fifty years.

Taiwan has in totaled seven national airlines however only five airlines are doing direct flight between the Taiwan Strait where the two biggest airlines are China Airlines and Eva Air. China Airlines is an airlines owned by the government and Eva air is owned totally by the

private sector. Following on the tables below, the Cross Strait Direct Flight Routes and Airlines would be presented:

Table 17. Cross Strait Direct Flight Routes and Airlines-Taiwan airlines

Taiwan Airlines	Routes	
China Airlines	Taoyuan	Pudong, Beijing, Guangzhou, Shenzhen, Qingdao, Wuhan, Chengdu, Xi'an, Dalian, Sanya, Wuxi, Haikou, Nanchang
	SongShan	Hongqiao
	Taichung	Chongqing, Nanchang
	Kaohsiung	Pudong, Beijing, Shenzhen, Chongqing
Eva Air	Taoyuan	Pudong, Beijing, Hangzhou, Guangzhou, Zhengzhou, Jinan, Tianjin, Chengdu
	SongShan	Hongqiao
	Kaohsiung	Pudong, Ningbo, Guangzhou
TransAsia Airways	Taoyuan	Changsha
	SongShan	Pudong and Hongqiao, Hefei, Wuhan, Tianjin, Chongqing, Fuzhou, Hangzhou
	Taichung	Pudong, Xiamen, Fuzhou
	Kaohsiung	Fuzhou, Xiamen
Mandarin Airlines	Taoyuan	Shenyang, Changsha, Nanjing, Ningbo, Xiamen, Zhengzhou
	Taichung	Fuzhou, Hangzhou, Ningbo
	Kaohsiung	Hangzhou, Xiamen
Uni Airways	Taoyuan	Shenzhen, Ningbo, Qingdao, Dalian, Chongqing, Nanjing, Fuzhou
	SongShan	Xiamen
	Taichung	Xiamen, Shenzhen, Hangzhou, Ningbo, Nanjing
	Kaohsiung	Hangzhou, Fuzhou, Qingdao

Source: Civil Aeronautics Administration (updates until 2012/3/15)

Taiwanese Airlines that are doing Cross Strait flight are: China Airlines, Eva Air, TransAsia Airway, Mandarin Airlines and Uni Airways as shown on table 17, what route and by which airport each Taiwan airlines have connect each cross strait route.

With the opening of direct flight, new competitors are entering the market as some airlines of Mainland China.

Table 18. Cross Strait Direct Flight Routes and Airlines-Mainland China airlines

China Airlines		Routes
Air China	Taoyuan	Pudong, Hangzhou, Beijing, Tianjin, Chongqing, Chengdu
	SongShan	Hongqiao
China Eastern Airlines	Taoyuan	Pudong, Nanjing, Ningbo, Kunming, Xi'an, Qingdao, Hefei, Wuhan, Nanchang, Taiyuan, Shijiazhuang
	SongShan	Hongqiao
China Southern Airlines	Taoyuan	Pudong, Guangzhou, Shenzhen, Shenyang, Wuhan, Changsha, Zhengzhou, Changchun, Dalian, Guiyang, Nanning, Harbin, Guilin
Hainan Airlines	Taoyuan	Beijing, Guangzhou, Haikou, Dalian, Xi'an
Xiamen Airlines	Taoyuan	Xiamen, Fuzhou, Changsha, Hangzhou
	SongShan	Xiamen, Fuzhou
	Taichung	Xiamen
	Kaohsiung	Xiamen, Fuzhou
Shandong Airlines	Taoyuan	Yantai, Qingdao, Jinan
Sichuan Airlines	Taoyuan	Kunming
	SongShan	Chengdu, Chongqing
Shenzhen Airlines	Taoyuan	Shenzhen, Shenyang

Mainland China Airlines that are doing Cross Strait flight are: Air China, China Eastern Airlines, China Southern Airlines, Hainan Airlines, Xiamen Airlines, Shandong Airlines, Sichuan Airlines and Shenzhen Airlines as shown on table 18, what route and by which airport each Mainland China airlines have connected each cross strait route. Another interesting data about Mainland China air transportation is that the country protects their countries flag carriers and has their airport classified into national, regional and local airport based on their connectivity to others airports (C.C. Lin). After the signing of direct air policy, Taiwanese airlines and carriers are only able to touch Mainland China international airport but airport that is opened for Cross Strait activities. Otherwise, airlines and carriers need to find some Chinese airlines or carriers to help them connect with others regions inside Mainland China. Thus, it is common to observed cooperation agreement as alliance and code sharing between some Mainland China and Taiwan airlines. This kind of cooperation agreements helps airlines to find more opportunities, route connection, more market share and productivity to their business.

The planning of airlines network is a very sensitive issues that each airlines companies need to elaborate according to their business goal, objective and strategy they want to target. There are many factors that airlines and carriers take in consideration when planning the aircraft utilization, schedules, strategies and routes. The decision for carriers of choosing their air network it is essential for all their future economic and strategic development. Emphasizing again that carriers would serves only route when a market demand is there or for strategy reason.

Table 19.Cross Strait Cargo Flight

Origin	Destination	Number of flights per week (times)	Route Mileage (kilometer)
Taipei	Shanghai (Pudong)	19	845
Taipei	Nanjing	2	989
Taipei	Chongqing	7	2,932
Taipei	Xiamen	4	817
Taipei	Fuzhou	5	811
Taipei	Guangzhou	13	1,033
Cross Strait Cargo Flight		50	7,427

Source: Civil Aeronautics Administration (2011)

Direct Flight agreement allows airlines from both sides to serve new routes. According to Civil Aeronautics Administration (2011), approximately 50 cargo flight per week work between Mainland China and Taiwan. Based on 2011 statistic, the most busy route departure from Taipei was Shanghai Pudong, Guangzhou, Fuzhou, Chongqing, Xiamen and Nanjing; 19, 13, 7, 5, 4, and 2 flight per week, respectively. (see table 19)

On the other hand, airlines can determine the profitability and revenue potential of their routes by measuring of the amount of utilization of the total available capacity of a transport vehicle, load factor. As shown in figure 18. Cross-Strait passenger numbers and load factor, many tourist and business people are using the direct flight. The figure compares the number of cross strait passenger and load factor between 2009 and 2011, the highest the load factor is, it is best for airlines.

Figure 18. Cross-Strait passenger numbers and load factor: Sep-2009 to Jul-2011
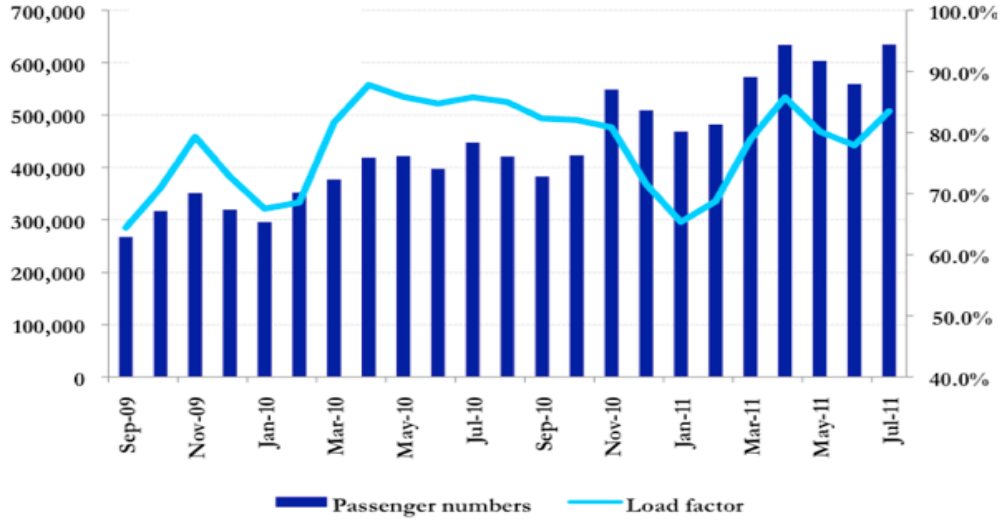
The largest operator serving between Taiwan and China are China Airlines, EVA Air, China Eastern Airlines, Mandarin Airlines, Air China and TransAsia as shown in figure 19. China to Taiwan (seats per week, one way): 04-Jul-2011 to 04-Mar-2012

Figure 19. China to Taiwan (seats per week, one way): 04-Jul-2011 to 04-Mar-2012
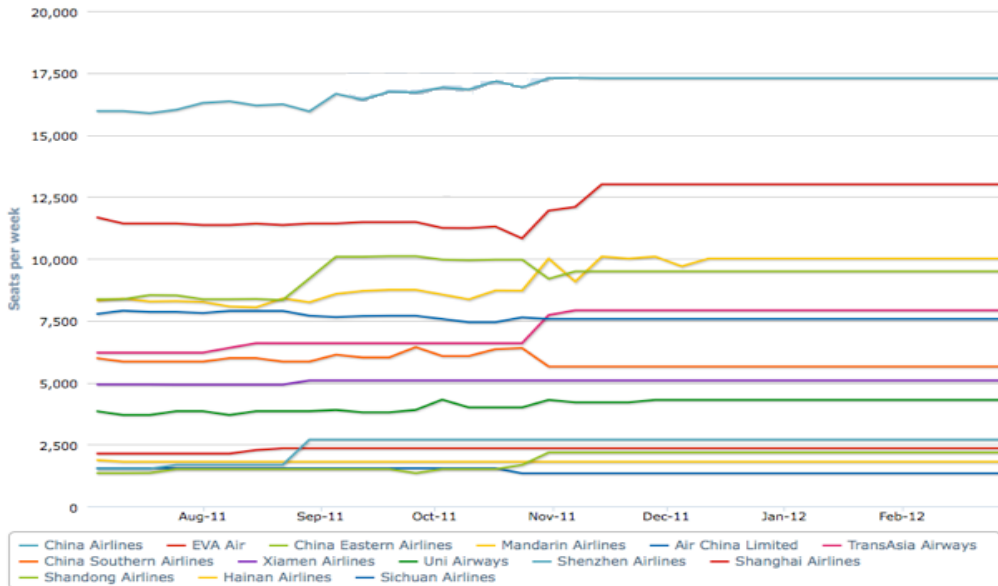
Table 20. Cargo movement at Taiwan airports I. (Airport with more flow of good)

Year	Taoyuan Airport	Kaohsiung Airport	Songshan Airport	Magong Airport	Kinmen Airport
41 年	-	-	3,122.0	-	-
45 年	-	-	1,958.0	-	-
50 年	-	-	5,756.0	-	-
55 年	-	661.8	14,243.0	270.0	-
60 年	-	4,694.9	54,033.4	2,058.6	-
65 年	-	26,571.1	116,730.1	3,733.3	-
70 年	215,153.3	19,267.9	7,187.6	6,954.2	-
75 年	377,949.6	30,222.4	5,861.3	6,678.7	-
80 年	634,389.9	46,284.4	14,033.8	10,680.5	2,527.3
85 年	796,459.8	63,269.4	9,785.1	10,229.0	1,755.8
88 年	1,057,237.0	90,675.8	10,342.8	3,708.4	6,792.9
89 年	1,208,838.4	101,756.2	11,009.5	4,236.3	6,881.3
90 年	1,189,873.6	88,743.8	13,924.0	5,344.0	6,628.7
91 年	1,380,748.3	95,781.7	17,085.9	4,980.0	9,436.8
92 年	1,500,070.7	84,602.5	17,112.8	5,288.6	9,508.2
93 年	1,701,020.3	87,758.2	15,220.1	5,149.7	8,015.5
94 年	1,705,317.8	81,453.4	14,006.2	5,715.2	6,515.8
95 年	1,698,808.2	76,997.0	15,024.2	6,687.2	5,706.1
96 年	1,605,681.0	70,241.3	13,115.3	7,254.8	6,412.2
97 年	1,493,120.0	62,139.4	11,830.8	6,819.7	8,220.4
98 年	1,358,303.7	54,382.0	11,405.7	6,897.8	9,348.4
99 年	1,767,074.8	64,850.8	14,355.0	7,075.0	9,137.9
100 年	1,627,462.4	55,364.4	34,492.0	7,073.1	8,676.5
Total	**21,317,508.6**	**1,205,718.3**	**431,634.6**	**116,834.1**	**105,563.8**

Source: Civil Aeronautical Administration (1952-2011)

As Cross Strait agreement progress, more passenger and cargo airport would go to handle. The table 20 and table 21 show the cargo movement at Taiwan airport. The table 20 shows those Taiwan airports that have more cargo movement. The busiest airport at Taiwan in term of cargo movement is Taoyuan airport, Kaohsiung airport, Songshang airport, Magong airport and Kinmen airport. On the other hands, the table 21 shows those airports with medium cargo movement rates such as Taichung airport, Hualien airport, Tainan airport and Taitung airport.

Table 21. Cargo movement at Taiwan airports II

Year	Taichung Airport	Hualien Airport	Tainan Airport	Taitung Airport
41 年	-	-	-	-
45 年	-	-	-	-
50 年	-	701.0	-	-
55 年	-	694.0	348.0	132.0
60 年	202.2	2,092.6	412.0	0.1
65 年	554.6	3,117.5	1,469.8	407.4
70 年	208.7	1,673.9	825.8	975.6
75 年	369.1	1,134.3	841.2	1,170.1
80 年	696.7	2,142.8	1,900.3	1,220.3
85 年	1,393.6	450.6	670.2	600.6
88 年	1,921.9	690.8	992.0	591.9
89 年	2,068.5	1,035.8	1,198.0	576.4
90 年	1,683.2	1,270.4	1,198.0	565.9
91 年	1,876.5	1,228.3	1,206.9	475.0
92 年	2,035.8	1,232.5	1,320.0	420.1
93 年	1,636.4	884.4	1,784.4	397.1
94 年	1,639.3	769.5	1,776.5	411.6
95 年	1,659.6	782.5	1,939.1	390.4
96 年	1,564.7	948.2	1,643.5	437.1
97 年	1,722.9	751.2	832.4	357.7
98 年	1,946.9	597.8	647.9	391.2
99 年	2,294.0	594.0	733.1	351.2
100 年	2,132.7	541.0	569.5	376.2
Total	**27,607.3**	**23,333.2**	**22,308.6**	**10,247.9**

Source: Civil Aeronautical Administration (1952-2011)

2.4. Cross Strait Current Problem

This section would introduce briefly some factors that can have negative impact on the freight transportation system. Following, we would mention some number of factors that can contribute to constrained freight mobility and have significant adverse economic, environmental, and health impacts.

2.4.1. Growing Freight Transportation Demand

The growing freight transportation demand decreases freight mobility. Literatures suggested that the growth demand for transportation could be a factor that can trouble the smooth process in the freight transportation system. As shown in the figure 21. Example of Goods Air Movement from Shipper to Consumer, there is many freight transportation stakeholders involved in maintaining and improving the freight transportation system. Each stakeholder has complex and varied roles, but none are responsible for the entire system. Government agencies planner are the principal responsible for planning and funding new infrastructure and maintaining existing infrastructure. A bad planning could cause higher direct economic costs for producers and consumers. Public planning agencies may also work with ports, shippers, and terminal operators to forecast freight volumes and plan needed system improvements to port infrastructure.

Figure 20. Example of Goods Air Movement from Shipper to Consumer
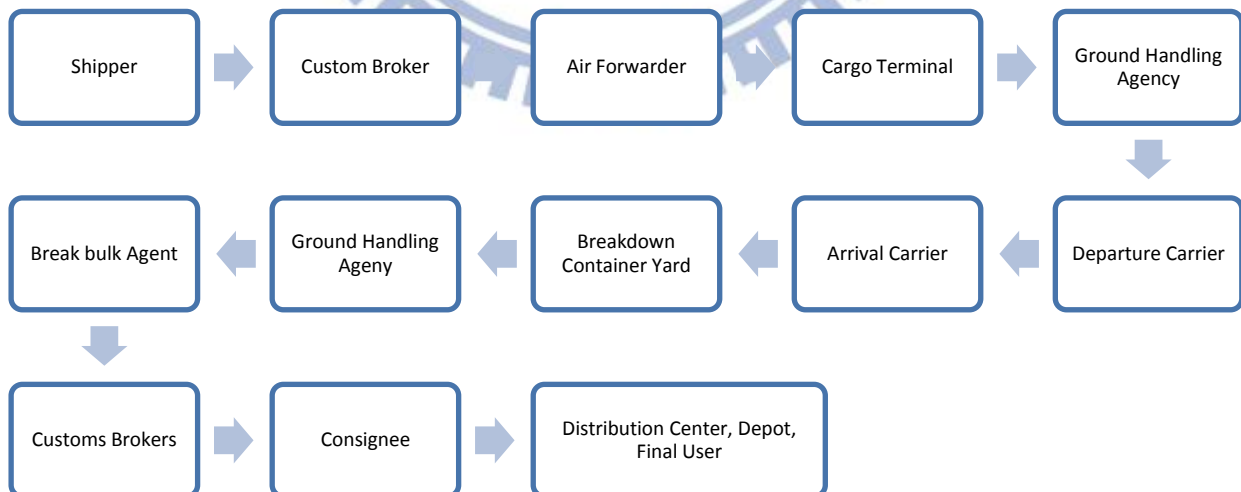
Source: Institute of Transportation (2012)

Table 22. Cargo Traffic by Airlines

Cargo Traffic	China Airlines	Eva Air	TransAsia Airline	Mandarin Airlines	Uni Air	Far East Airline
Import	33,836.520	29,264.086	727.549	364.194	366.008	-
Export	44,983.721	36,883.869	906.134	1,246.220	552.267	-
Re-export	85,102.140	78,941.135	104.122	1,841.681	3,731.024	-
Total	163,922.381	145,089.090	1,737.805	3,452.095	4,649.299	-

Table 23. Cargo volume (percentage) by Airlines

Cargo Volume	China Airlines	Eva Air	TransAsia Airline	Mandarin Airlines	Uni Air	Far East Airline
Taiwan areas	22.13	19.14	0.48	0.24	0.24	-
International &Cross Strait	25.20	20.67	0.51	0.70	0.31	-
Re-export Route	46.40	43.04	0.06	1.00	2.03	-
Cargo volume %	31.84	28.18	0.34	0.67	0.90	-

The ECFA policy has boom visitor from Mainland China for tourism at Taiwan and the exchange of good between the two sides. Mr. Mao Chikuo has urged Taiwanese carriers to purchase more aircraft before the number of Mainland tourists permitted to visit the island increases from 5 million presently to 10 million passengers over the next three to four years. Cargo traffic and volume has increased due to the ECFA. As shown in table 22 and table 23, the cargo traffic and volume statistic of Civil Aeronautical Administration. The Cross Strait activities are still a new topic therefore the issue and activities related to it, it is still immature. With the passage of time, demand may change more aggressively. Therefore, the government concern about the cargo and passenger shortage capacity.

Mr. Mao Chikuo state that Taiwan's passenger fleet is not adequate to meet current market demand and has urged local carriers to show more interest in expanding their capacity (CAPA). According to Ascend, Taiwanese airlines have 44 aircraft on firm orders, predominantly wide-bodied.

Figure 21.Taiwan fleet breakdown for on-order aircraft (at 12-Sep-2011)
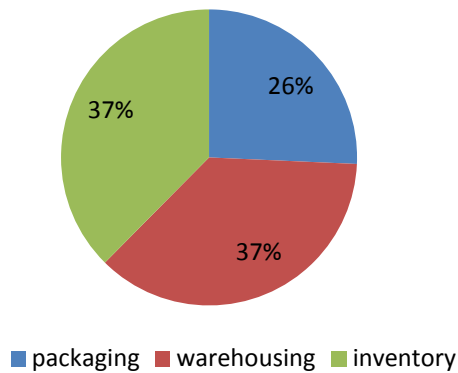
Currently, Taiwan has 7 national airlines which are China Airlines, Eva Air, Uni Air, TransAsia Airways, Far Eastern Air Transport, Mandarin Airlines and Daily Air. But not all those airlines are serving the Cross Strait market. Based on Civil Aeronautics Administration until June, 2011, Taiwan airlines have 196 aircraft registered (see Table 24). The biggest Taiwanese airlines, China Airlines and EVA Air are responding to the Cross Strait demand. China Airlines states that they would expand its fleet from 68 to more than 100 aircraft in the next five to 10 years. Meanwhile, EVA Air states that they would acquire 20 aircraft to meet robust demand from China.

Table 24. Numbers of Aircraft registered

Airlines	Numbers of Aircraft registered
China Airlines	67 aircrafts
Eva Air	50 aircrafts
Uni Air	19 aircrafts
TransAsia Airways	16 aircrafts
Far Eastern Air Transport	10 aircrafts
Mandarin Airlines	8 aircrafts
Daily Air	7 aircrafts

With the flexibility of air freedom, airlines and carriers often chose to reconfigure their networks development so they can achieve certain benefit like access to more markets (Y.Y.

Lau et al). On the other hand, Taiwanese airlines are claiming for opening Mainland China airspace and relax visa for Mainland China people with the aims of turning Taiwan into an Asia-Pacific hub. [21] By flying through China's airspace, airlines could take 30 minutes off the flight time and save the company US$3.39 million a years, said Mr. Chang Kuo-Wei (Jen Kastener, 2011). And by relaxing visa procedure can allow Taiwanese airlines to attract more passenger to their hub and robust other route served by them.

2.4.2. Business Operational Performance

Problems may exist because the policy has not yet matured. The opening direct flight in Taiwan Strait brings a lot of negative and positive impact to air carriers. Having access to a bigger market like Mainland China, this can make Taiwanese airlines try to adjust their corporate strategic and development to current situation. Airlines industries measure their profitability by the seat and weight load factor. The majority of Chinese airlines revenue is coming from their domestic market. In other words, China airlines have a very low weight load factor but a very high seat load factor. Airlines of Mainland China target their domestic market.

Table 25. Taiwanese and Mainland China Airlines operational performances I

Year	Taiwan		Mainland China		
	China Airlines	EVA Air	Air China	China Eastern	China Southern
Total revenue ('000 USD)					
2001	N/A	1,551,804	1,867,066	1,417,132	1,582,837
2002	2,283,087	1,867,749	2,064,835	1,617,831	1,628,936
2003	2,204,054	1,899,808	3,017,449	2,455,879	3,092,168
2004	2,877,597	2,473,082	4,125,370	2,546,916	2,060,636
2005	3,378,854	2,736,219	4,896,753	3,221,121	4,774,130
2006	3,750,103	2,886,587	5,748,207	4,404,916	6,078,811
2007	3,866,787	2,834,880	6,192,444	5,608,170	7,188,330
2008	3,973,128	2,876,405	7,650,343	6,043,202	7,985,127
2009	3,109,900	2,217,299	7,523,524	5,707,656	8,022,544

Source: The implications of the re-establishment of direct links across the Taiwan Strait on the aviation industries in Greater China (2012)

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[21] Jen Kastner, Taiwan airlines target mainland's airspace, Asia Times Online, 2011.

In contrast, Taiwan-based airlines, such as, China Airlines and EVA are among the world's leading air cargo operators which mean that Taiwan airlines rely on air combination business. Taiwanese airlines revenue is coming from both weight load factor and seat load factor. Literature pointed out that passenger airlines are likely to achieve higher productivity level if they engage in more cargo business.[22]

(Y.Y. Lau et al) in his research about the re-establishment of direct link, he compares operational performance of some major airlines of Mainland China and Taiwan. Y.Y. Lau et al detect that Mainland China airlines have more passenger load factor than Taiwanese airlines because the major business of Mainland China airlines is their own market. Mainland China airlines had lowest load factor in the region especially when cargo operation are included. However, Taiwanese operational performance becomes better when airlines are measure by their weight load factor. This mean that Mainland China airlines market is target only passenger but Taiwanese airlines business is a mix business where passenger and cargo are vital for it performance (see below Table 20).

Based on Y.Y.Lau research, it is very important for Taiwanese airlines to note their weakness and strengthens, and tries to develop strategy in order to avoid negative effect on their business industry. (Wang Lu et al) survey about who composed Mainland China and Taiwan Cross Strait passenger flight. Based on their investigation, people who are doing business are the one who use more direct flights (2008). Then, follow by people who are visiting their relatives and tourism. Based on Wang Lu et al research, airlines industries could target business traveler market. The large amount of business men traveling may be travelers that have some manufacturing, factory, or other economic activities established in Mainland China. Yuqing Xing state that approximately 83% of foreign investments firms in Mainland China are from Taiwanese. The principal reason of this investment is for high tech assembly. Based on statistic, the high weighting load factor on Taiwanese carriers can be due that laptop PCs, digital cameras and all i-product that are sent from Taiwan to be assembled on Mainland China.[23] As Mainland China labor is very cheaper, many enterprise Mainland China low labor cost and not their how-know technology labor.

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[22] Lau, Y.Y. et al, 2012, The implication of reestablishment of direct links across the Taiwan Strait on the aviation industries in Greater China, Research in Transportation Economics.

[23] Yuqing Xing, China's High Tech Export: Myth and Reality, June 2011.

Table 26. Taiwanese and Mainland China Airlines operational performances II

Operational performances of major airlines in greater China				
Year	Taiwan		Mainland China	
	China Airlines	EVA Air	Air China	China Eastern	China Southern
Passenger load factor (RPK/ASK, Unit %)				
2001	N/A	74.9	64.1	61.6	62.5
2002	75.1	77.5	68.3	64.9	65.4
2003	69.4	72.7	66	60.9	63.8
2004	77.1	75.3	71.9	66.6	68.3
2005	76.5	74.4	74.2	69.4	67.6
2006	77	75.1	76	71.3	71.7
2007	77.5	77.4	78.6	73.6	74.6
2008	76.8	77.2	75	70.8	73.9
2009	75.8	77.4	76.9	72.2	75.4
Company load factor (RTK/ATK, Unit %)				
2001	N/A	71.8	56.6	56.7	59.2
2002	76.8	75.8	60.9	60.7	61.1
2003	73.1	72.7	60.5	61.2	59.6
2004	76.3	75.3	63.2	61.7	61.9
2005	74.2	74.4	65.1	60.6	61.1
2006	72.7	75.1	65.4	62	63.5
2007	71.5	77.4	67.7	63.4	64.9
2008	70.8	77.2	66.6	61.4	64.2
2009	71.5	78.9	66.9	62.1	64.9

Source: The implications of the re-establishment of direct links across the Taiwan Strait on the aviation industries in Greater China (2012)

As shown in figure 22. Cost per available ton kilometer of major airlines in Mainland China (weight load) and figure 23. Cost per available seat kilometer of major airlines in Mainland China (Seat load), in term of overall cost, Mainland China airlines had the lowest average cost in term of CASK. However, if compare the overall cost in term of CATK, Taiwan airlines had the lowest average cost in term of CATK.

Past literature suggest that Chinese airlines have good profitability because Chinese airlines enjoy lower price for input such as labor, food supplies and because of the size of their domestic market. Based on statistic, the important for Taiwanese airlines to know their

weakness and strengthen so they can incorporate strategy and lead their business into cost effectiveness benchmark.[24]

Figure 22. Cost per available seat kilometer of major airlines in Mainland China (Seat load)
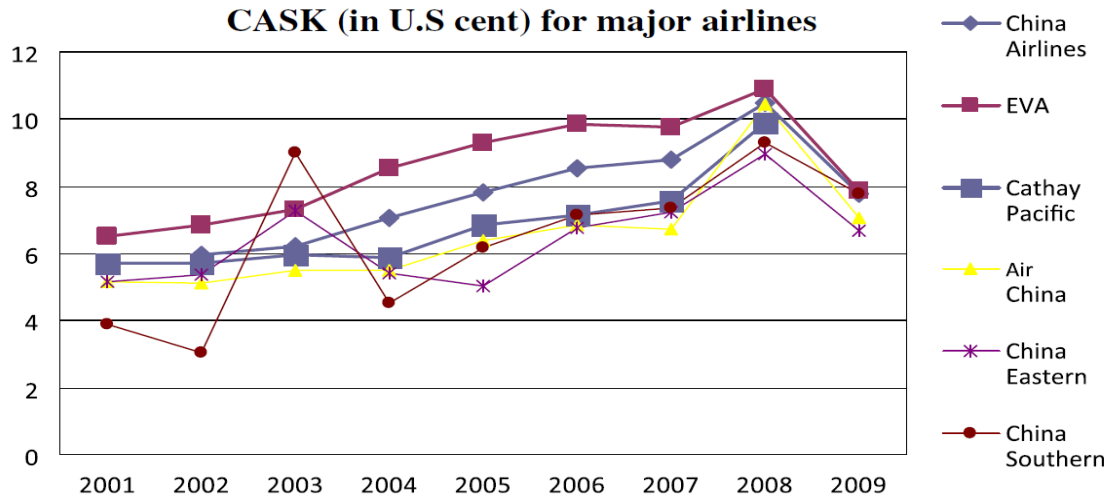
Source: The implications of the re-establishment of direct links across the Taiwan Strait on the aviation industries in Greater China (2012)

Figure 23. Cost per available ton kilometer of major airlines in Mainland China (weight load)
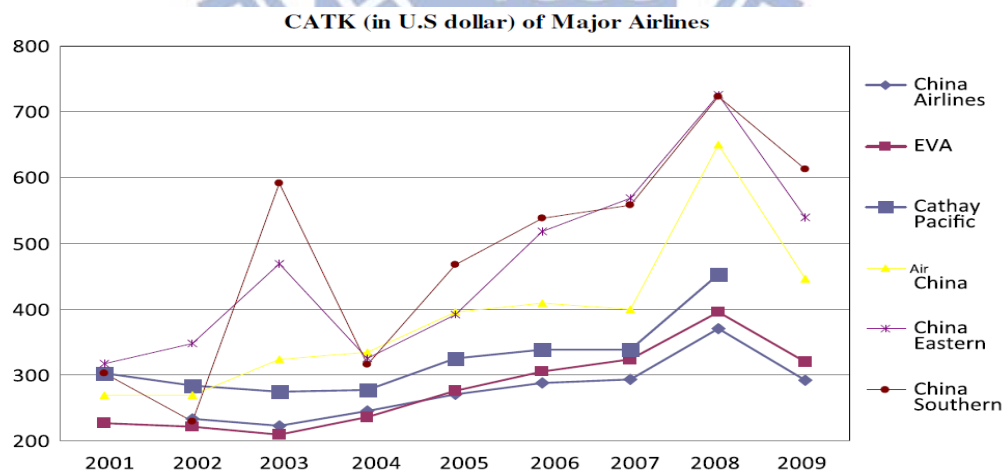
Source: The implications of the re-establishment of direct links across the Taiwan Strait on the aviation industries in Greater China (2012)

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[24] Lau, Y.Y., The implications of the re-establishment of direct links across the Taiwan Strait on the aviation industries in Greater China, 2012.

2.5.3. Transportation Capacity

Another problem in freight transportation is that the capacity of transportation system could constrained by other factors, including the cost of surmounting geographic barriers, such as mountain ranges and waterways, population density, and urban land-use development patterns.

Figure 24. Songshan Airport

Source: Wikipedia (2012)

A very good example of constrained by urban land use development pattern is Songshan airport located in the cities of Taipei. The airport covers an area of 182 hectares (1.82 km^2). The airport serves Taiwan, mainland China, South Korea, Japan routes and other international routes. At Songshan airport Cross Strait direct flight began on June 14, 2010. Each week has 28 flights, served by China Eastern Airlines, Shanghai Airlines, Air China, China Airlines, EVA Air, and TransAsia Airways. The airport is undergoing upgrades to its runway and it is trying to reduce its jet bridge from eight to six (due to lack of space) to accommodate Airbus A330 and Boeing 767.

Freight movement in population centers and along major corridors is constrained by the physical barriers created by urban land-use development patterns and the built-up urban environment, such as buildings and other facilities that are adjacent to ports, rail yards, and highways. According to several shippers, the areas surrounding critical freight infrastructure are increasingly dense with development, making it more difficult and expensive to build or expand centrally located freight facilities. In some regions with nationally significant freight

flows, geography and patterns of land development constrain freight mobility, making it difficult to cost-effectively increase infrastructure capacity.

The situation of Songshan airport is because it is situated in the heart of downtown and because of its proximity to the city; Songshan airport cannot easily accommodate growth in passenger and freight transportation due to its location inside Taipei City's central business district, the city suffers from the noise, pollution, restrictions on urban planning, and traffic congestion the airport brings about.

There is a plan proposed to close Songshan Airport, and developed its land into road, huge park, detention basin and sports arena, since the Taiwan High Speed Rail could quickly take up the traffic load between Taipei and western Taiwan cities, and the remaining service to outlying islands and eastern Taiwan could be easily taken over by the Taiwan Taoyuan International Airport after the completion of Taoyuan International Airport Access MRT System in early 2014. Also, the MRT system will make the international potential of Songshan airport less attractive.[25]

According to studies on transportation infrastructure investments and several of the stakeholders view, intermodal connections could also failed to keep pace with demand capacity. Intermodal infrastructure improves the connections between modes, which, in turn, can improve freight mobility. GAO states that if the nation's transportation system lacks adequate intermodal connections to efficiently move freight across modes, this can constrain freight mobility. For example, the roads that connect airports to highways are heavily used by trucks but are often in poor condition, creating freight bottlenecks.

Consequently, freight distribution centers have moved away from the urban core to suburban where land values are comparatively lower and in some situation the access to airports would be more difficult. Major transportation corridors are also increasingly squeezed by development and population density, and freight infrastructure expansion along these corridors is difficult to implement or simply does not occur. However, as a result of this land-use pattern, trucks must travel farther from airports to distribution centers and from distribution centers to final destinations.

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[25] Wikipedia, http://en.wikipedia.org/wiki/Taipei_Songshan_Airport.

2.4.3. Infrastructure Inefficiencies

There have been wide debates about how to minimize such impacts and improve profitability of airlines. One promising approach is to study the robustness of airline infrastructures. Based on statistic, the volume of domestic and international freight moving through the Taiwan has increased dramatically, and continued growth is expected in the future. Another problem that freight transportation could found is the widening gap between the volumes of goods and available system capacity. This could increase transportation congestion.

Figure 25. Taipei Taoyuan International Airport passenger numbers: 2009 to 2011
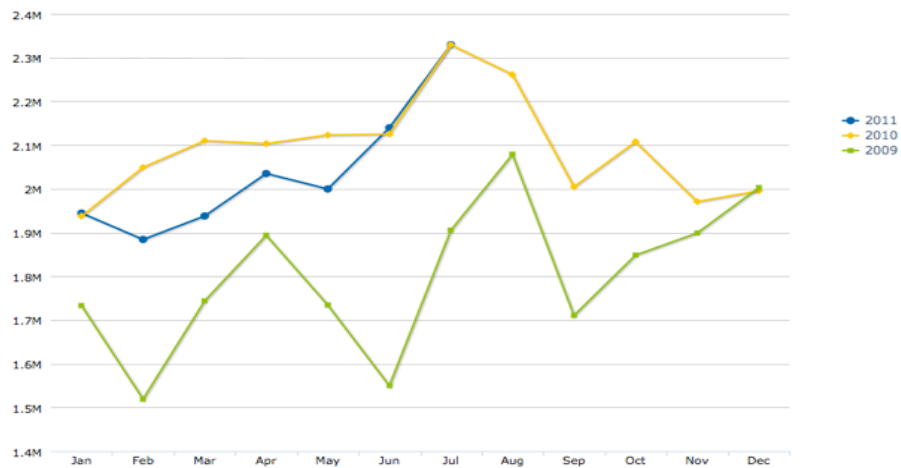
Source: CAPA - Centre for Aviation

Figure 26. Taipei-Taoyuan International Airport cargo volume: 2009 to 2011
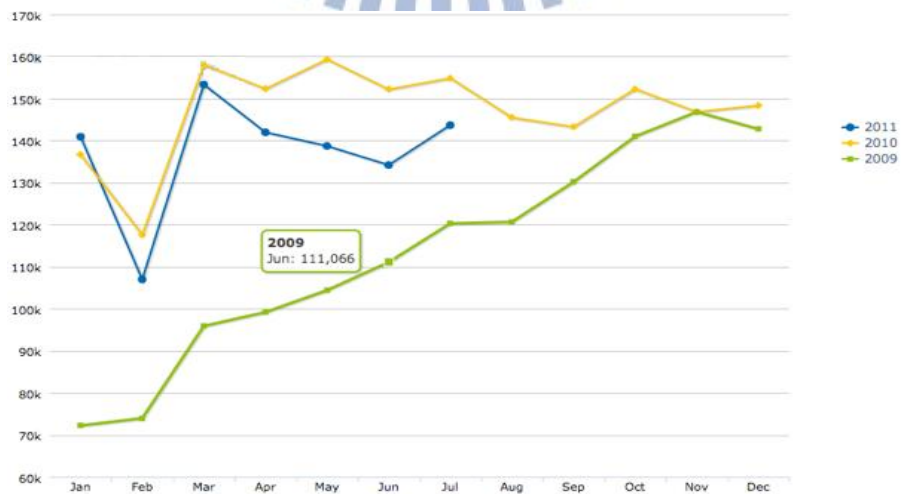
Source: CAPA - Centre for Aviation

Concurrently, the capacity of the nation's freight transportation infrastructure has not increased at the same rate as demand. Inefficiencies in the use of freight infrastructure also limit the system's capacity. All these factors can contribute to increasing passenger and freight transportation system congestion.

Therefore if Taiwan wants to potential as a regional logistics hub, there needs to be long term and timely development of Taiwan airport and port cargo facilities, including cargo terminals and cargo aircraft parking. Cargo terminal capacity is not an issue at present. Taiwan airport development for cargo has a tradition of falling behind demand for several years. There is a need to be better planning of development for cargo facilities (Us Taiwan Business Council).

Freight mobility is limited by inefficiencies in how infrastructure is used and can result in congestion. Another aviation industry that seems to be affected by the direct air flight between the Taiwan Strait is airport. They are affected more in their growth of throughput and in the increase of their utilization ratio. Taiwan airports posses good geographical advantage and has been considered ideal for the development of air transport nodes.

However, Taiwan airport are facing difficulties in operation (Wang Lu et al). In term of air traffic, only several airports can make more than 100 airplane movements daily such as Taoyuan, Songshan, Taichung, and Kaohsiung. Taiwan still has others smaller airports but the air traffic that they can handle is lower than 10 airplane and airport facilities idle seriously.

Table 27. Airport performance can directly and indirectly influence logistics trends.

Type of flight	China	Taiwan	
	Regular Schedule	Regular Schedule	Charter
Airport	27	2	6
Regular flight executed	136	107	
Charter flight executed			28

Source: The impact of direct air transportation link cross Taiwan Strait on air passengers transportation of China mainland, Taiwan, Hong Kong and Macao

With the cross strait direct flight, the air traffic has growth. Thus, Taiwan airport need to growth and develop their facilities in order to receive the future demand. Apart, airports have to consider Mainland China market. Its market size is bigger than Taiwan and Mainland

China have more airport than Taiwan. The concern is that Taiwan airports have to be careful about how much air traffic they can handle because airport performance can directly and indirectly influence logistics trends. GAO states that higher indirect costs, such as passenger traffic congestion costs could affect the quality of life of all transportation users. Additionally, the airline network is an infrastructure vulnerable to outside perturbations and system inefficiencies have large economic cost.

2.4.4. Environmental Pollution and Social cost to nearby communities

Table 28. What are an Airport's Impact?

Key Impacts	Terminal & Ground operation		Flight	Airport access		Associated projects	
	Construction	Operation	Operation	Construction	Operation	Construction	Operation
air pollution			-		-		-
biodiversity impacts	-	-	-	-	-	-	
climate change		-	-		-		
employment and economic benefits	+	+	+			+	+
heritage	-		-	-	-	-	
land take	-			-		-	
landscape	-	-		-		-	-
noise		-	-	-	-		
risk and public safety zones			-				
social costs to nearby communities	-	-			-		
traffic	-	-		-	-	-	-
water pollution		-			-		
water use		-					-

Source: Planning Guide

A different problem that could constrained freight mobility and could adverse economic costs for consumers, shippers, and carriers, as well as in urban centers is when congestion make worse and bring more environmental pollution and increases health risks, such as respiratory illnesses. Congestion caused by constrained freight mobility has led to

negative effects that impact both the direct users of freight services—producers, shippers, and receivers—as well as passenger traffic and individuals living in congested areas. These impacts include higher direct economic costs for freight services and indirect economic costs borne by passenger traffic impacted by freight congestion.

Besides, constraints on freight mobility cause negative environmental impacts, such as air pollution, and their associated health risks, particularly to vulnerable populations living next to congested areas. Consequently, transportation costs impact the total cost of many goods and services and affect all the stakeholders in the supply chain, as these costs are factored into the prices they charge their customers. In table 22.What are an Airport's Impact? shows the difference activities around airport and airlines activities and the impact each activities could cause.
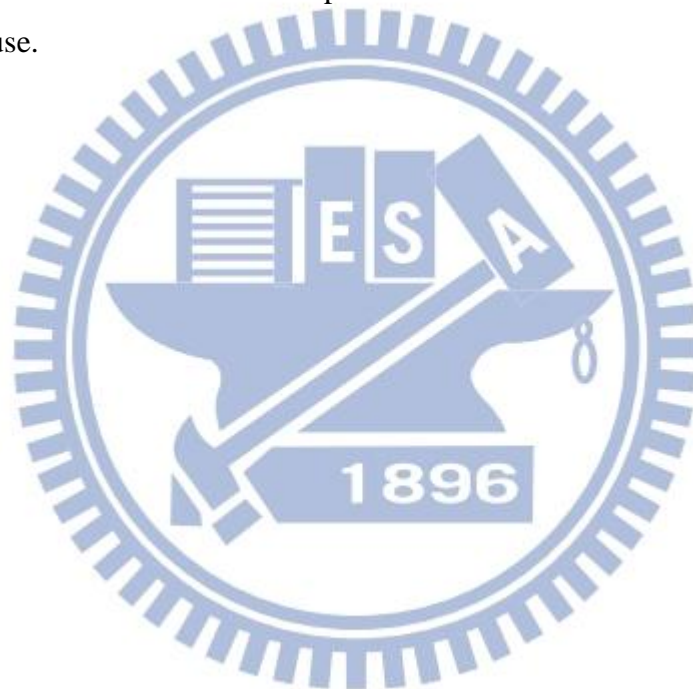
2.5. Methodology Literature Review

This research methodology would use the following methods such as Survey, and AHP approach for the development of analysis about the effect and cause produce by the Cross Strait Air Transportation Policy on Taiwanese aviation industries. Following, brief description and use of each method that would be used in this research:

2.5.1. Survey

The survey is a non-experimental and descriptive research technique. It is useful when a researcher wants to collect data on a particular situation or phenomenon that cannot be directly observed.[26] Survey collect quantitative information about the population is sampling. The author Basha and Harter (1980) state that "a *population* is any set of persons or objects that possesses at least one common characteristic." The purpose of a survey is to gather data on the sampling population attitudes, impressions, opinion, satisfaction level, and others.[27] As survey research is always based on a sample of the population, and the success of the research is dependent on the representativeness of the population of concern.

Typically, survey data are collected through the use of questionnaires, while sometimes researchers directly interview their target population. Surveys can use qualitative or quantitative measures. This mean survey can use ask open-ended questions or use forced-choice questions.

Before designing questionnaire, there are some steps to follow such as:

1. Pick up carefully the research criteria
2. Select sample stakeholder targeting
3. Decide on survey response format

   Busha and Harter suggest the use an attractive questionnaire format that conveys a professional image.
4. Design the survey question

Some authors recommend for the designer of survey questionnaire the following suggestion such as: Babbie suggestions are: to make items clear, make sure the question asks only one clear thing, don't ask questions that the respondent won't accurately be able to answer and any questions should be relevant

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[26] http://www.gslis.utexas.edu/~palmquis/courses/survey.html
[27] http://www.businessdictionary.com/definition/survey.html

Busha and Harter recommended: to avoid slang, jargon, and technical terms, make sequence questions from the general to the specific and to make the questions as easy to answer as possible.

  5. Choice the mode of data collection

As many other research method, survey also has their benefit and weakness in their procedure and developing step. A continuation, a list of advantage and disadvantage that could be found in doing survey is listed below.

Advantage of using survey method:

1. Surveys are flexible in the sense that a wide range of information can be collected.
2. They can be administered from remote locations using mail, email or telephone.
3. Consequently, very large samples are feasible, making the results statistically significant even when analyzing multiple variables.
4. Many questions can be asked about a given topic giving considerable flexibility to the analysis.
5. Only questions of interest to the researcher are asked, recorded, codified, and analyzed.

Disadvantage of using survey method:

1. Question answer-choices could lead to vague data sets
2. Those with closed ended questions may have low validity when researching affective variables.
3. Stakeholder may not be motivated to give accurate answer

2.5.2. Analytic Hierarchy Process

The Analytic Hierarchy Process was developed at the Wharton School of Business by Dr. Thomas Saaty in 1970s. Since then, AHP has been successfully used in thousands of organizations around the world. Many years of deployments has shown the effectiveness of AHP in business and governmental decision making.

The AHP is a structured technique for organizing and analyzing complex decisions. The AHP helps decision makers discover the choice that best suits their goal. It has particular application in group decision making, and is used in fields such as government, business, industry, healthcare, and education.

Analytic hierarchy process is a methodological approach which implies structuring criteria of multiple options into a system hierarchy, including relative values of all criteria, comparing alternatives for each particular criterion and defining average importance of alternatives.[28] It provides a comprehensive and rational framework for structuring a decision problem, for representing and quantifying its elements, for relating those elements to overall goals, and for evaluating alternative solutions.

Figure 27. A simple AHP structure
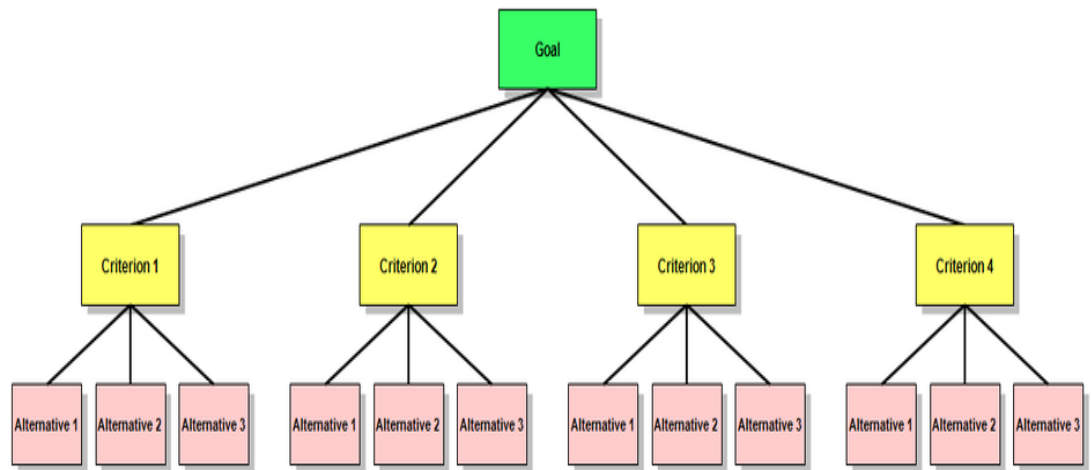
Source: Wikipedia (2012)

AHP lets you organize criteria in the form of hierarchy - from the most general to the specific ones. This allows you to better organize the factors influencing the decision. Other multi-criteria decision making (MCDM) methods typically are based on the list of criteria.The main purpose of the Analytic Hierarchy Process is to obtain the weight of the criteria and evaluate the set of alternative that best fix the problem. An interesting feature of this technique is that it allows users to assess the relative weight of multiple criteria or multiple options against given criteria (Nadja Kasperczyk and Karlheinz Knickel).

The Analytic Hierarchy Process has some step to follow such as descriptive below:

1. To structure the hierarchy process to generate the criteria
2. To do the pair comparison between criteria
3. To compute the weights

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[28] Ivan Pogarcic, Miro Francic, Vlatka Davidovic, Application of the AHP method in Traffic Planning, 2008.

4. Check the consistency

5. Sensitivity Analysis

Firstly, users of the AHP decompose their decision problem into a hierarchy of more easily comprehended sub-problems, each of which can be analyzed independently.

Then, when the hierarchy is built, the users can systematically assess its elements by comparing them to one another two at a time, with respect to their impact on an element above them in the hierarchy.

Following, the AHP converts those evaluations to numerical values that can be processed and compared over the entire range of the problem. A numerical weight or priority is derived for each element of the hierarchy, allowing diverse and often incommensurable elements to be compared to one another in a rational and consistent way. AHP allows you to enter information about your preferences in a very intuitive way. It involves comparing elements in pairs: identifying the dominant one and determining the degree of dominance in the nine point scale (other MCDM methods often require support from the specialized decision analyst).

Table 29. AHP verbal scale-Saaty scale

Intensity of importance	Definition	Explanation
1	Equal importance	Two elements contribute equally to the objective
3	Weak importance	Experience and judgment slightly favor one element over another
5	Essential importance	Experience and judgment strongly favor one element over another
7	Very importance	One element is favored very strongly over another; its dominance is demonstrated in practice
9	Absolute importance	Extreme importance
Intensities of 2, 4, 6, and 8 can be used to express intermediate values.		

Source: Adapted from Saaty

In the final step of the process, numerical priorities are calculated for each of the decision alternatives. These numbers represent the alternatives' relative ability to achieve the decision goal, so they allow a straightforward consideration of the various courses of action.

There are many researchers that have been subject about some weakness and strengthen of the AHP method. Below, some researcher opinion about this technique:

Advantage of AHP model:

1. AHP has flexibility, intuitive appeal to the decision makers and its ability to check inconsistencies (Ramanathan 2001).

2. Users can find the pairwise comparison form of data input straightforward and convenient.

3. AHP method can decomposes a decision problem into its constituent parts and builds hierarchies of criteria (Macharis et al. 2004).

4. AHP reduces bias in decision making.

5. The AHP method supports group decision−making through consensus by calculating the geometric mean of the individual pairwise comparisons (Zahir 1999).

Disadvantage of AHP model:

1. Ranking irregularities when some variants are used.

2. Detailed and important information can be lost by such aggregation.

3. Artificial limitation of the use of the 9 point scale.
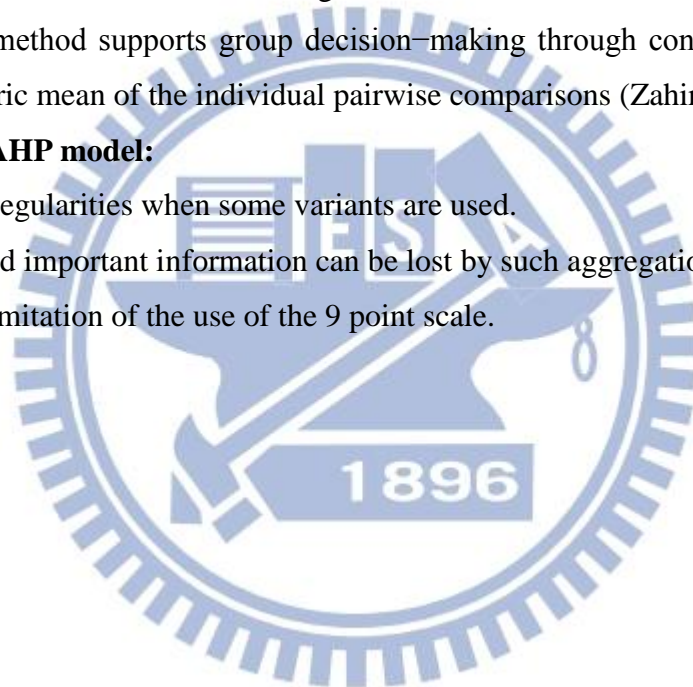
III. Research Methodology

This research chapter would go through in detail about the research method performed in this study, including the conceptual framework of the research model, AHP approach, development of questionnaire for survey, along with the sampling process will also be explained in depth. And finally, data processing and analysis procedure would be presented.

3.1. Research Conceptual Framework

The purpose of this study is to observe what happen after an implementation of transportation policy, in the case of Taiwan, the Cross Strait Direct Air Transportation Policy. The study tries to examine how Taiwanese aviation industries perceived the effect and impact of the Direct Air Transportation Policy on their business logistic, distribution and economy. A research framework is presented for further understanding for the readers.
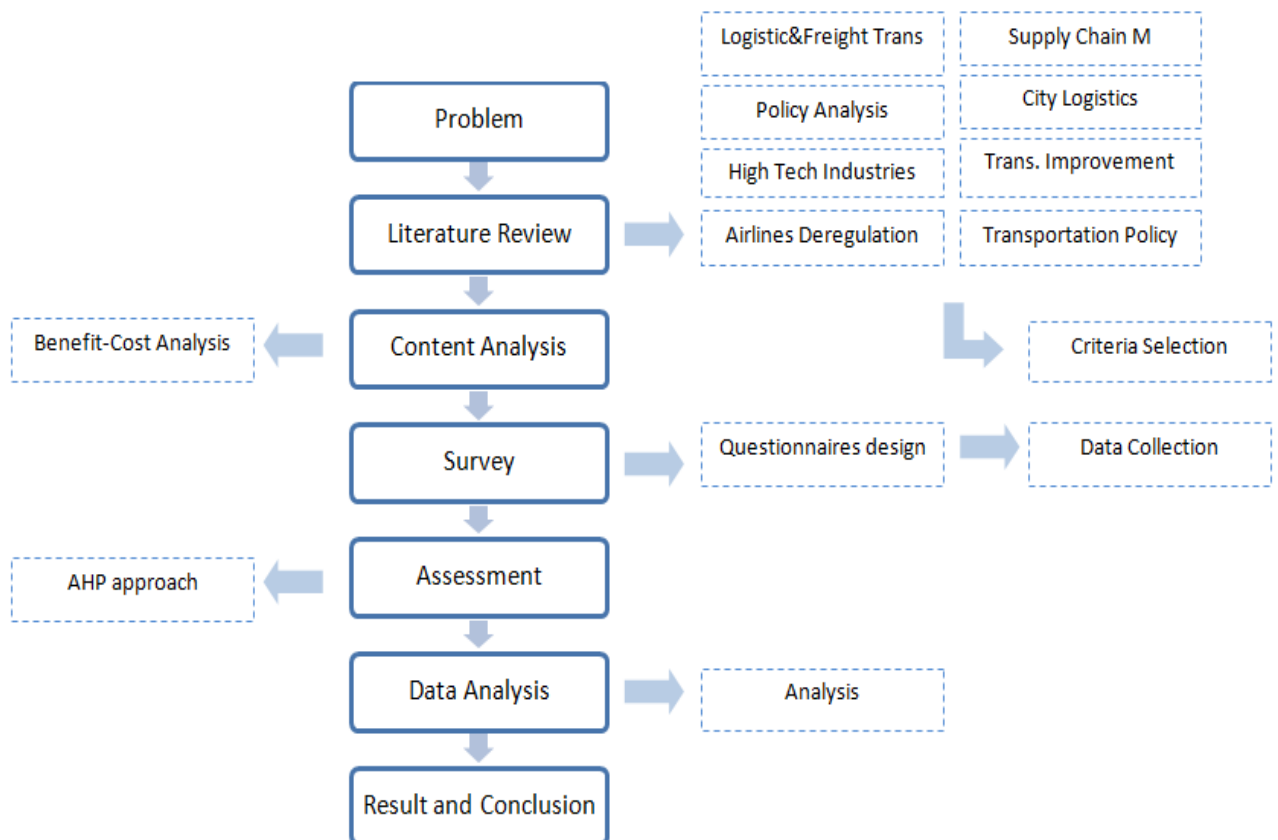
Figure 28. Research Framework

First of all, the problem of air transportation between Mainland China and Taiwan was reviewed; literature about Cross Strait conflict and direct air transportation was analyzed. After reviewing and analyzing information, many literatures suggest that an inefficient transportation system can led to a number of adverse effects causing higher direct economic costs for carriers, producers and consumers; and higher indirect costs, such as costs that can affect the quality of life of all transportation users.

Growth of transportation demand, geographic barriers, transportation policies, transportation capacities, inefficiencies infrastructure are some factor that can contribute to constrained freight mobility. The Cross Strait Direct Air Transportation Policy serves to eliminate the constrained allowing carriers and shipper to have more control of their business logistic performance.

As the focus of this research study is about freight transportation, literature about the relation between manufacturing and carriers was reviewed. Logistic, Supply Chain Management, Transportation improvement, policy analysis, AHP, survey, transportation efficiency, distribution, generative effects and freight transportation system literature were examined and these are what have shaped this study research.

3.2. Research Criteria

Figure 29. AHP Framework - Criteria level
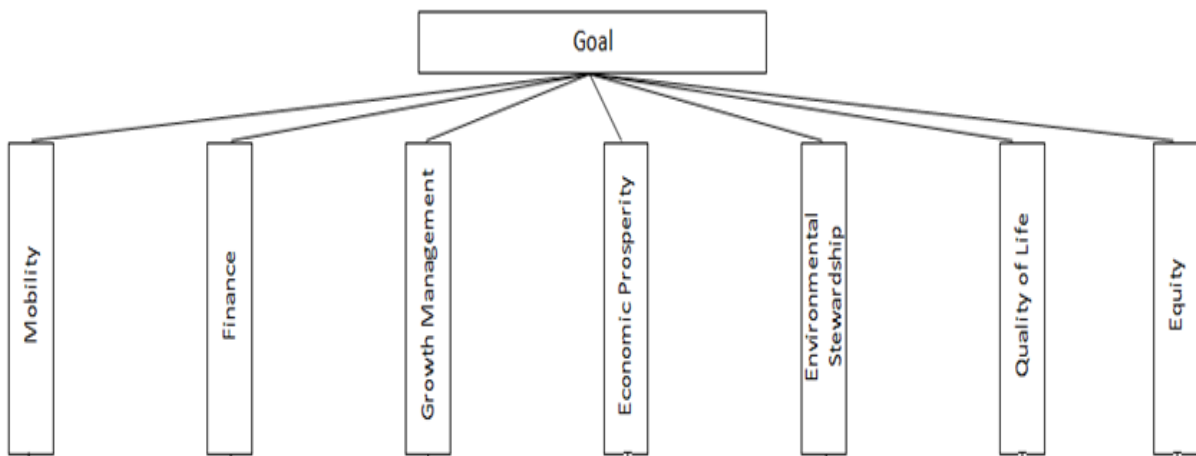
<div align="right">Source: This research data</div>

The selected criteria and their sub-criteria for evaluation of the impact of the Cross Strait Direct Flight Policy on carriers, shippers and government are shown below. Each criteria and sub-criteria connotation would be explained briefly. Seven criteria are selected after reviewing several literatures. These factors would be used to evaluate which impact of having direct air transportation aviation industries desire or concern more about. Each criterion corresponds to measure the most Air Policy effect desire by carriers, shippers, and society.

1. Mobility

Under the mobility criteria, there are 4 sub-criteria that would try to define which benefits gain is more appreciated by air transportation system users.

M1. Travel Time Savings: linked with the wages paid to drivers plus the time cost of cargo inventory for commercial vehicles.

M2. Improved Reliability Benefits: related to schedule improvement and consistency.

M3. Vehicle Operating and Ownership Benefits: related to operating cost.

M4. Other User Benefits: related to user cost.

2. Finance

Under the finance criteria, there are 4 sub-criteria that would try to identify what cost is more concerning for air transportation system users.

F1. Facility Operating Cost: related to economic resources required to operate facilities, products and services.

F2. Capital Cost: related to economic resource required to make capital investment to facilities, products and services.

F3. Operating Revenues: related to the revenues generated as part of the operations of the transportation improvements or programs.

F4. Influence of Finance on the Economy: related to broader tax instruments have potential consequences on economic activity by distorting non-transportation related economic decisions and displacing productive economic activity. This would bring in the increasing of general taxes to pay for the transportation investments

3. Growth Management

Under the growth management criteria, there are 4 sub-criteria that would try to figure out which population and employment distribution within the region is desire for each stakeholder.

GM1. Population: related to number of person within the region, area, geographic.

GM2. Employment: related to number of jobs within the region, area, geographic. Increased share of jobs in region, area, geographic is an important indicator of job opportunities and accessibility within the area.

GM3. Jobs to Housing Balance: related to ratio of jobs to person by region, area. A jobs-person ratio closer to the regional ratio would imply that residents have close and improved access to job locations, minimizing the need to make long work commutes, or to make lengthy trips to meet daily needs.

GM4. Population and Jobs in Centers: related to number of population and jobs within the regional growth center and manufacturing industrial center. The centers are intended to attract residents and businesses because of their proximity to services and jobs, a variety of housing types, and their access to regional amenities

4. Economic Prosperity

Under the economic prosperity criteria, there are 3 sub-criteria that would try to estimate which factor of transportation system that may tend to improve or degrade economic vitality have more important for each air transportation system users.

EP1. Benefits Low and High-wage Employment: related to Investments in the transportation infrastructure would improve multimodal accessibility and then improved ability to attract jobs in high wage and low wage job sectors from outside the region.

EP2. Benefits to Cluster Employment: related to changes in user benefits that accrue to parts of the region with high concentrations of employment in existing cluster industries.

EP3. Benefits to Freight-Related Employment: related to investments in the transportation infrastructure would improve accessibility to freight-related industries and then provide incentives for more freight to move through the region.

5. Environmental Stewardship

Under the environmental stewardship criteria, there are 5 sub-criteria that would try to define which pollution has higher relevant.

ES1. Vehicle and Stationary Emission Benefits: Vehicle and building use results in the production of various pollutants, each of which imposes costs in terms of property damage, human and environmental health.

ES2. Impervious Surfaces: A key indicator of the health of the region's water resources is the amount of impervious surface across the region as whole.

ES3. Agriculture and Natural Resource Lands: The pressure to develop agricultural and natural resource lands will increase as the development on land nearby increases. This pressure will increase the potential to lose agricultural and natural resource lands to development. This potential reduction in natural resource lands is seen as a injury to the environment.

ES4. Energy Usage from Vehicle and Building Use: Buildings and vehicles consume fuel and electric energy to operate. Energy consumption contributes to greenhouse gases and other pollutants.

ES5. Noise Level: related to the noise produced by freight transportation system and indirect economical activities.

6. Quality of Life

Under the quality of life criteria, there are 3 sub-criteria that would try to find out what improve in the quality of life is more important for the transportation system users.

QL1. Accident Cost Savings: The costs of accident risk are determined by the probability of an accident, severity of accidents and the costs that are incurred as a result of accidents. All of these factors are influenced by loadings and speeds on transportation facilities.

QL2. Non-motorized Travel: As growth patterns provide more housing in proximity to employment and vice versa, there are more opportunities for user to choose their freight transportation.

QL3. Redundancy: Redundancy measures can indicate the capacity of the system to support users (air freight) if specific elements of the systems were to fail.

7. Equity

Under the equity criteria, there are 4 sub-criteria that would try to observe what distribution of transportation system prefer each stakeholder

E1. Geographic Distribution of Benefits: Decision makers are interested in the way that benefits of transportation projects are distributed across the region.

E2. Income Distribution of Benefits: Decision makers are interested in the way that benefits of transportation projects are distributed across segments of society.

E3. Benefits to Personal and Commercial Users: Decision makers are interested in the way that benefits of transportation projects are distributed across classes of vehicles.

E4. Benefits to Environmental Justice Populations: Decision makers are interested in the way that benefits of transportation projects are distributed across segments of society.

3.3. Sampling Design

1. Defining Stakeholders (Interest Groups):

This research study target primary Taiwanese aviation industries stakeholders. The population for the study would be air carrier, shipper and government. The air carrier population samples are Taiwanese airlines that flight the Cross Strait route. Besides, shipper samples are manufacturing and high tech industries. The selection of specific shipper industry is due to the nature and requirement of high tech cargo. And last, the government samples are those who have relation with the Cross Strait Air Policy and those who are involved in Cross Strait activities.

2. Confirming the sampling framework

2.1. Carrier:

The target population sampling is air cargo carriers. The population desire to target are sale department, export/import department, logistic department, and marketing department but related to cargo transportation department. Carriers are selected because any change on them, can influence positively on to high tech industries economy.

2.2. Shipper:

The target population samplings are High Tech companies. In this research the use of High tech companies is due to their business and logistic need characteristic. As high tech industries produce high-value products, they basically need the "just-in-time" in their supply chain management to maximize their operation.

2.3. Government:

The target populations are those departments related to the Cross Strait relation and some Taiwan airports. The airport would not go to be considering as a separate stakeholder

from government because airports are owner by them. Therefore, government stakeholder would be from the Institute of Transportation, Civil Aeronautical Administration, and airport.

Table 30. Thesis research target sampling population

Stakeholder Group	Air Cross Strait Stakeholder	Respondents	Job's Position
Shipper	• High Tech Industries	• Compeq • Hongdart Automation • Panasonic • Accer	• Logistic department • Supply Chain Planner • Manager • Administrative
Carrier	• Airlines Industries	• TransAsia Airways • China Eastern Airlines	• Cargo Department • Route Control • Administrative
Government	• Institute of Transportation • Airport • CAA	• Taoyuan Airport • CAA • IOT	• Aviation Engineer • Administrative • Logistic • Ground Staff

Source: This research data

3. **Choosing the sampling method**

   3.1.Analytic Hierarchy Process:

The purpose of using this methodology is due that it allows making pair wise comparison among criteria. As the Analytic Hierarchy Process is used in this research, the size of population sampling doesn't need to huge; a minimum of 5 per each target stakeholder is enough to make the computation of criteria weighting.

3.2.Survey Questionnaire:

To conduct the survey questionnaire the website mySurvey was used for this purpose. mySurvey was used due that it allow to elaborate AHP format questionnaire. Since questionnaire survey is done on internet, the entered answer are automatically stored and filed. This is the link to this research's survey questionnaire: http://www.mysurvey.tw/s/3jMEY3en. As mySurvey sometime is very low then also Interview survey was done to collect the opinion of the targeted stakeholder. (to see survey questionnaire refer to appendix)

3.4. Survey Questionnaires Design

For this research survey, mySurvey[29] is used for the confection of the questionnaires survey due that this website provide tool to develop AHP questionnaire. Following, some sample illustrating the survey questionnaire format. Basic information of participant was required such as respondent profession area and experience in the area.

Figure 30. Respondent's basic information

Source: This research data

In figure 30 shows how respondent's basic information format look like. Then, as AHP is used to make pair wise comparison among criteria, Saaty scale format is used. Saaty scale have 9 degree intensity such as Absolute important represented by 9, Very Important represented by 7, Essential Important represented by 5,Weak Important represented by 3, Equal Important represented by 1 and the number 2, 4, 6, 8 are middles value. In figure 31 shows how the format for an AHP survey questionnaire is.

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[29] Website: www.mysurvey.tw

Subsequently, the elaboration of the pair wise comparison matrix is done by layer, which means that first pair wise comparison matrixes is done for criteria, and then follow to the lower layer with pair wise comparison matrix. In figure 31 shows on the AHP Framework how many layers have.

Figure 31. Questionnaire Survey Format

Criteria A	Absolute important	Very Important	Essential Important	Weak Important	Equal Important	Weak Important	Essential Important	Very Important	Absolute important	Criteria B
	9	7	5	3	1	3	5	7	9	
C1										C2
C1										C3
C2										C3

Figure 32.Thesis Research AHP Framework
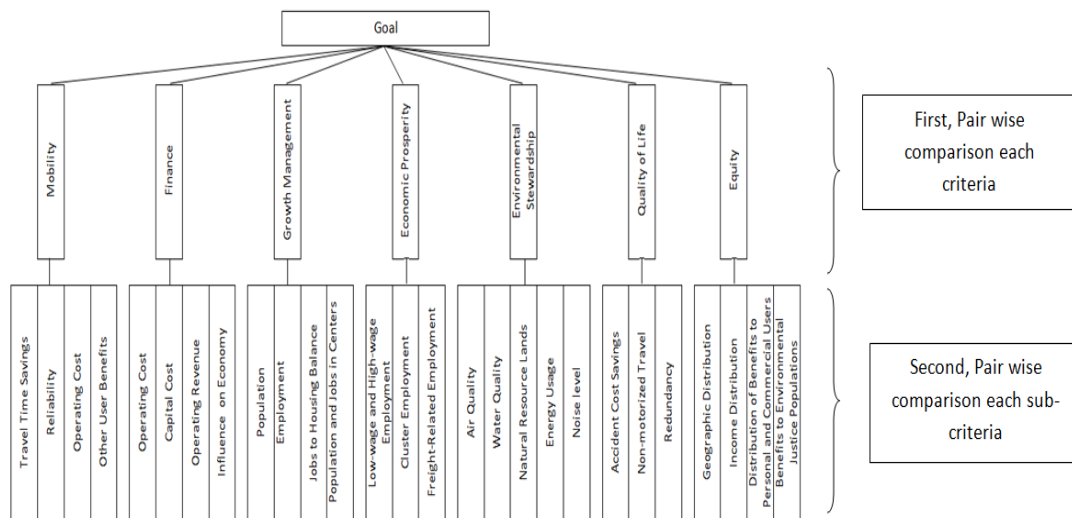
Figure 33. Sample of Questionnaire Survey Format for Criteria

	Absolute important 9	Very important 7	Essential important 5	Weak important 3	Equal important 1	Weak important 3	Essential important 5	Very important 7	Absolute important 9	
Mobility *	◎	◎	◎	◎	◎	◎	◎	◎	◎	Finance
Mobility *	◎	◎	◎	◎	◎	◎	◎	◎	◎	Growth Management
Mobility *	◎	◎	◎	◎	◎	◎	◎	◎	◎	Economic Prosperity
Mobility *	◎	◎	◎	◎	◎	◎	◎	◎	◎	Environment Stewardship
Mobility *	◎	◎	◎	◎	◎	◎	◎	◎	◎	Quality of Life
Mobility *	◎	◎	◎	◎	◎	◎	◎	◎	◎	Equity
Finance *	◎	◎	◎	◎	◎	◎	◎	◎	◎	Growth Management
Finance *	◎	◎	◎	◎	◎	◎	◎	◎	◎	Economic Prosperity

Source: This research data

In figure 33 shows a sample of Questionnaire Survey Format for Criteria while in figure 34 shows a sample of Questionnaire Survey Format for Finance sub-criteria

Figure 34. Sample of Questionnaire Survey Format for Finance sub-criteria

	Absolute important 9	Very important 7	Essential important 5	Weak important 3	Equal important 1	Weak important 3	Essential important 5	Very important 7	Absolute important 9	
Operation cost *	◎	◎	◎	◎	◎	◎	◎	◎	◎	Capital cost
Operation cost *	◎	◎	◎	◎	◎	◎	◎	◎	◎	Operating revenues
Operation cost *	◎	◎	◎	◎	◎	◎	◎	◎	◎	Influence of finance on the economy
Capital cost *	◎	◎	◎	◎	◎	◎	◎	◎	◎	Operating revenues
Capital cost *	◎	◎	◎	◎	◎	◎	◎	◎	◎	Influence of finance on the economy
Operating revenues *	◎	◎	◎	◎	◎	◎	◎	◎	◎	Influence of finance on the economy

Source: This research data

3.5. Analytical Hierarchy Process Model

Analytical Hierarchy Process model is based on four steps: problem modeling, weights valuation, weights aggregation and sensitivity analysis.[30]

3.5.1. Problem modeling

In a decision-making processes, the structure the problem, which can be divided into three parts: goal (Stakeholder satisfaction), criteria (criteria and its sub-criteria) and alternatives (in this research no alternative is presented). AHP has the advantage of permitting a hierarchical structure of the criteria, which provides users with a better focus on specific criteria and sub-criteria when allocating the weights.

The first step in the AHP model is to define the goal and objectives of the research. Goal and objectives set up as shown in table 31. Goal and objectives. This step is important, because a different structure may lead to a different final ranking.

Table 31. Goal and objectives

Goal and Objectives	
Goal	Satisfaction of stakeholder
Objectives	1. Improve the mobility of people and goods in the region. 2. Promote economic prosperity. 3. Protect the natural environment. 4. Promote an overall high quality of life. 5. Distribute transportation benefits and costs equitably. 6. Create an efficient land use pattern for the provision of infrastructure, facilities, and services.

Source: This research data

Following, model the structure in a hierarchy way containing the goal as the higher layer of the structure. Subsequent, follows by criteria as the second layer and the sub-criteria

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[30] Alessio Ishizaka and Ashraf Labib, Analytic Hierarchy Process and Expert Choice: Benefits and Limitations, 22(4), p. 201–220, 2009.

as the third layer of the hierarchical structure as shown in figure 35. Analytic Hierarchy Process framework,

Figure 35. Analytic Hierarchy Process framework
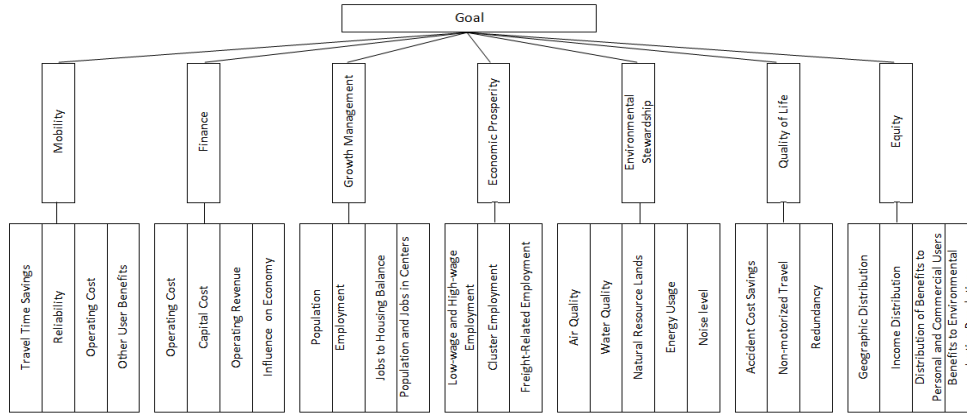
Source: This research data

3.5.2. Pairwise Comparisons

Figure 36. Pairwise comparison example

Criteria	C1	C2	C3	C4	C5	C6	C7
C1	1						
C2		1					
C3			1				
C4				1			
C5					1		
C6						1	
C7							1

Sub-criteria	M1	M2	M3	M4
M1	1			
M2		1		
M3			1	
M4				1

Source: This research data

At each node of the hierarchy, a matrix will collect the pairwise comparisons of the decision-maker. Then, establish matrices of pair-wise comparisons according to AHP framework and questionnaire results. As this study AHP has 3 layer levels, where the second level is located the criteria and the last layer levels located each criterion sub-criteria. Then, as there are 7 criteria approximate 8 matrices of pair-wise comparisons are established.

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3.5.3. **Judgment Scales**

Table 32. The AHP verbal scale ranges 1 to 9 (Saaty scale)

Intensity of importance	Definition	Explanation
1	Equal importance	Two elements contribute equally to the objective
3	Weak importance	Experience and judgment slightly favor one element over another
5	Essential importance	Experience and judgment strongly favor one element over another
7	Very importance	One element is favored very strongly over another; its dominance is demonstrated in practice
9	Absolute importance	Extreme importance
Intensities of 2, 4, 6, and 8 can be used to express intermediate values.		

One of AHP's strengths is the possibility to evaluate quantitative as well as qualitative criteria and alternatives on the same preference scale of nine levels. These can be numerical, verbal or graphical (Expert Choice).

3.5.4 **Priorities derivation**

Once the comparisons matrices are filled, priorities can be calculated. The traditional AHP uses the eigenvalue method. Computation of eigenvalue by the relative weights the criteria and the sum is taken over all weighted eigenvector entries.

Pair wise comparison data can be analyzed using the eigenvalue technique. Using these pair wise comparisons, the parameters can be estimated. The right eigenvector of the largest eigenvalue of matrix A constitutes the estimation of relative importance of attributes.

$$A = \begin{bmatrix} 1 & \alpha_{12} & \cdots & \alpha_{1n} \\ 1/\alpha_{12} & 1 & \cdots & \alpha_{2n} \\ \vdots & \vdots & 1 & \vdots \\ 1/\alpha_{1n} & 1/\alpha_{2n} & \cdots & 1 \end{bmatrix}$$

Then, if the matrix A is consistent, then A contains no errors (the weights are already known) and we have:

$$a_{ij} = w_i/w_j, \quad i,j = 1,2,\ldots,n.$$

The $\displaystyle\sum_{j=1}^{n} a_{ij}w_j = nw_i, \quad i = 1, 2, \ldots, n,$ which in matrix notation, is equivalent to Aw=nw. The vector w is the principal right eigenvector of matrix A corresponding to the eigenvalue n. If the vector of weights is not known, then it can be estimated from the pair wise comparison of matrix A generated by the decision maker by solving for:

$$\hat{A}\hat{w} = \lambda_{\max}\hat{w}.$$

The matrix A contains the pair wise judgments of decision maker and approximates matrix A whose entries are unknown.

3.5.5. Consistency

As priorities make sense only if derived from consistent or near consistent matrices, a consistency check must be applied. Several other methods have been proposed to measure consistency. Peláez and Lamata (2003) describe a method based on the determinant of the matrix. Crawford and Williams (1985) prefer to sum the difference between the ratio of the calculated priorities and the given comparisons. The transitivity rule has been used by Salo and Hamalainen (1997) and later by Ji and Jiang (2003). Alonso and Lamata (2006) have computed a regression of the random indices and propose the formulation: λmax $< n +$ 0.1(1.7699n-4.3513). Stein and Mizzi (2007) use the normalized column of the comparison matrix.

Saaty (1977) has proposed a consistency index (CI). Saaty (1977) has shown that the largest eigenvalue, l max of a reciprocal matrix A is always greater than or equal to n. If the pair wise comparisons do not include any inconsistencies, lmax $= n$. The more consistent the maximum comparisons are, the closer the value of computed lmax to n.

A consistency index (CI), which measures the inconsistencies of pair wise comparisons is given in:

$$C.I. = \frac{\lambda'_{\max} - n}{n - 1} \qquad\qquad CR = 100\left(\frac{CI}{RI}\right)$$

Where CI is the consistency index; λmax is the maximal eigenvalue; RI is the random index; and n is the number of columns. The RI is the average of the CI of a large number of randomly generated matrices, where n is the matrix size. Judgment consistency can be checked by taking the CR of CI with the appropriate value in Table 33. If CR is less than 10%, then the matrix can be considered as having an acceptable consistency (Saaty, 1980).

Table 33. Consistency Table

Size of matrix	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Random Consistency	0.00	0.00	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49	1.51	1.48	1.56	1.57	1.58

Source: Adapted from Saaty

3.5.6. Aggregation

The last step is to synthesize the local priorities across all criteria in order to determine the global priority. The historical AHP approach (called later distributive mode) adopts an additive aggregation with normalization of the sum of the local priorities to unity

$$p_i = \sum_j w_j \cdot l_{ij}$$

Where pi is the global priority of the alternative i; lij is the local priority; wj is the weight of the criterion j.

3.5.7. Geometric Mean

In case that researcher doesn't have the software Expert Choice, there is other way to compute an overall result; researcher could make the evaluation of ranking intensity. The geometric mean is used in the AHP model for the overall assessment in case that there have more than 1 respondent. The formula of geometric mean followed as follow:

$$b_{ij} = (a_{1ij} \cdot a_{2ij} \cdots a_{kij})^{\frac{1}{k}}$$

3.5.8. Sensitivity Analysis

The last step of the decision process is the sensitivity analysis, where the input data are slightly modified in order to observe the impact on the results. If the ranking does not change, the results are said to be robust.

3.5.9. Expert Choice

As the Analytic Hierarchy Process (AHP) as it is implemented in the software package Expert Choice. The software Expert Choice[31] is available on the market which simplifies the execution of the AHP process and automates many of its computations. In short, there is no need to implement the steps manually. However, manual computation can be done with help of Microsoft Excel. Microsoft Excel can help to ease the computation process.

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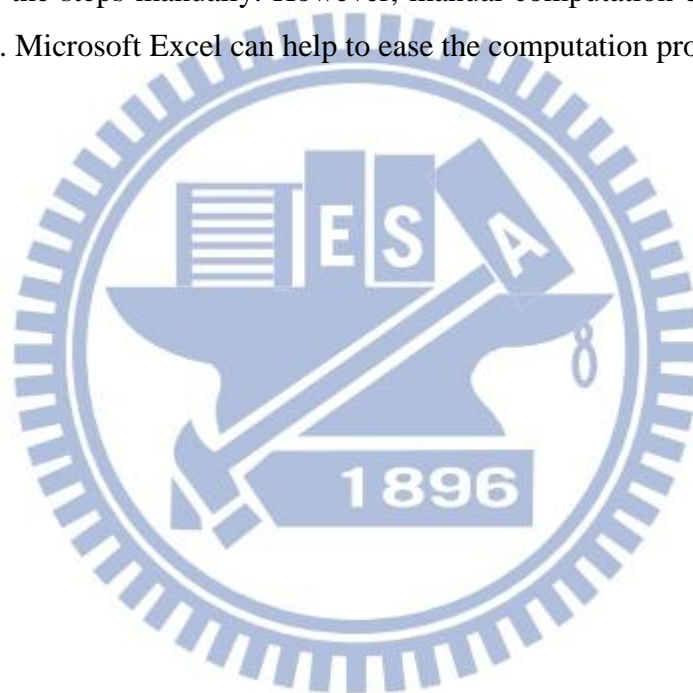
[31] www.expertchoice.com

IV. Data Analysis

4. Data Processing and Analysis Method

As the model used for this research is Analytical Hierarchy Process, the structure of questionnaire use the Saaty scale; absolute important, very important, essential important, weak important, equal important that are represented by 9, 7, 5, 3, and 1, respectively.

The AHP structure have 3 layer; goal, criteria and sub-criteria. We have 7 major criteria such as (1) mobility, (2) finance, (3) growth management, (4) economic prosperity, (5) environmental stewardship, (6) quality of life, and (7) equity.

This study has a total of 27 sub-criteria which are distributed in the following way: (1) mobility has 4 sub-criteria, (2) finance has 4 sub-criteria, (3) growth management has 4 sub-criteria, (4) economic prosperity has 3 sub-criteria, (5) environmental stewardship has 5 sub-criteria, (6) quality of life has 3 sub-criteria, and (7) equity has 4 sub-criteria.

4.1. Data Collection

Table 34. Data collection-Stakeholder request

Survey Data Collection	High -Tech Industries	Airlines Industries	Government	Total
Request Questionnaire	10	10	10	30
Response Questionnaire	9	7	10	26
Valid Questionnaire	7	6	8	21
Invalid Questionnaire	2	1	2	5
Valid Questionnaire rate				70%

Source: This research data

A total of 30 questionnaires were mail to the different stakeholder from May 1, 2012, the questionnaire recovery as shown in the table 28 is presented the request for survey for the different stakeholder. Only 26 people reply back the questionnaire where 21 are valid

questionnaire and the others 5 are invalid questionnaire. Then, the average of valid questionnaire rate is about 70%.

4.2. Test and Weighting Computation

Table 35. Criteria Inconsistency

	Second Layer	Third Layer						
	Major Criteria	Mobility	Finance	Growth M	Economic P	Environmental	Quality of Life	Equity
	CI	CI	CI	CI	CI	CI	CI	CI
1	0.21	0.32	1.87	0.10	0.28	0.53	1.21	0.01
2	0.16	0.16	0.15	0.12	0.13	0.11	0.13	0.13
3	0.20	0.19	0.70	0.26	0.28	0.21	0.28	0.26
4	0.10	0.14	0.19	0.12	0.13	0.18	0.03	0.13
5	0.54	0.28	0.12	0.10	0.03	0.17	0.08	0.13
6	0.16	0.04	0.16	0.12	0.03	0.18	0.03	0.12
7	0.12	0.01	0.19	0.19	0.00	0.11	0.03	0.13
8	0.12	0.12	0.13	0.12	0.08	0.08	0.13	0.20
9	0.12	0.16	0.16	0.16	0.01	0.09	0.01	0.20
10	0.77	0.31	0.77	0.32	0.48	0.48	0.02	0.19
11	0.12	0.08	0.12	0.10	0.01	0.09	0.01	0.13
12	0.11	0.09	0.15	0.00	0.06	0.20	0.13	0.06
13	0.19	0.13	0.18	0.12	0.13	0.07	0.13	0.19
14	0.13	0.06	0.06	0.12	0.13	0.03	0.13	0.12
15	0.20	0.20	0.20	0.13	0.13	0.00	0.13	0.06
16	0.18	0.00	0.00	0.13	0.00	0.00	0.13	0.00
17	-	-	-	-	-	-	-	-
18	0.10	0.10	0.04	0.10	0.11	0.18	0.20	0.09
19	0.19	0.10	0.06	0.13	0.03	0.00	0.00	0.00
20	0.16	0.13	0.07	0.06	0.04	0.13	0.13	0.12
21	0.19	0.12	0.06	0.06	0.13	0.00	0.13	0.06
22	0.20	0.00	0.10	0.20	0.13	0.18	0.00	0.20
23	0.12	0.17	0.18	0.12	0.13	0.03	0.00	0.12
24	0.13	0.01	0.03	0.06	0.00	0.12	0.00	0.06
25	0.15	0.18	0.14	0.20	0.13	0.19	0.00	0.19
26	0.21	0.12	0.19	0.20	0.17	0.00	0.13	0.19

Source: This research data

Firstly, need to check if the consistency test of the questionnaire (CI) is good enough, and seek consistency at all levels of the proportion of eigenvalues (at λmax). Knife root

smoked (1993) pointed out that the CI and CR, preferably less than 0.1, as the case may sometimes be allowed to 0.15. However, Deng Zhenyuan (2002) pointed out that the maximum allowable range of the CI value of 0.2. As in this research study most of the data consistency is around 0.2 then data selected for the study would have a CI and CR range below 0.2. From the 26 questionnaire collected, 5 questionnaire are invalid due that their CI and CR are higher than 0.2 as shown in the table below. The invalid questionnaire corresponds to participant 1, 3, 5, 10, and 17.

4.3. Analysis of all the AHP's level

Each stakeholder has a different opinion and need about their business industries therefore, a variety of stakeholder respondents were needed to understand the important of the criteria. As there are more than 1 participant, a geometric mean is used for the computation of all the matrix of the AHP's level and weighting as shown in the below tables.

4.3.1. Major criteria

The impact of the Cross Strait Air Policy on aviation industries take in consideration 7 criteria such as (1) mobility, (2) finance, (3) growth management, (4) economic prosperity, (5) environmental stewardship, (6) quality of life, and (7) equity.

Table 36. Airlines Industry - Major Criteria's Weighting

	M	F	GM	EP	ES	QL	E	Weighting	Ranking
M	1	1/1.99	1/2.61	1/1.94	1.20	1.73	1.27	0.105	5
F	1.99	1	1.44	1.73	3.13	4.09	2.39	0.263	1
GM	2.61	1/1.44	1	1	1.05	3.00	2.75	0.192	2
EP	1.94	1/1.73	1	1	1.66	3.31	2.50	0.187	3
ES	1/1.20	1/3.13	1/1.05	1/1.66	1	1.10	1.57	0.108	4
QL	1/1.73	1/4.09	1/3.00	1/3.31	1/1.10	1	1.10	0.069	7
E	1/1.27	1/2.39	1/2.75	1/2.50	1/1.57	1/1.10	1	0.076	6
Lambda: 4.045, **C.I.:**0.02, **C.R.:**0.02									
M: mobility, F: finance, GM: growth management, EP: economic prosperity, ES: environmental stewardship, QL: quality of life, E: equity.									

Source: This research data

As shown in the table 36, Airlines Industry care more about finance, growth management, economic prosperity, environmental stewardship, mobility, equity and quality of

life. This industry weights these criteria in the following way: 0.263, 0.192, 0.187, 0.108, 0.105, 0.076 and 0.069, respectively. While this level of the consistency test is CI = 0.02, CR = 0.02, are less than 0.1, then CI and CR fill with the requirements of consistency.

Table 37. High Tech Industry – Major Criteria's Weighting

	M	F	GM	EP	ES	QL	E	Weighting	Ranking
M	1	1/1.24	1.74	2.09	2.27	2.76	2.17	0.216	2
F	1.24	1	2.04	4.53	2.54	3.73	2.56	0.286	1
GM	1/1.74	1/2.04	1	1.40	1/1.25	1.30	1/1.17	0.110	4
EP	1/2.09	1/4.53	1/1.40	1	1/1.99	1.09	1.09	0.083	7
ES	1/2.27	1/2.54	1.25	1.99	1	1/1.26	1.27	0.116	3
QL	1/2.76	1/3.73	1/1.30	1/1.09	1.26	1	1/1.26	0.088	6
E	1/2.17	1/2.56	1.17	1/1.09	1/1.27	1.26	1	0.101	5
Lambda: 3.589, C.I.:0.02, C.R.:0.02									
M: mobility, F: finance, GM: growth management, EP: economic prosperity, ES: environmental stewardship, QL: quality of life, E: equity.									

Source: This research data

On the other hand, High Tech industry concern more about finance, mobility, environmental stewardship, growth management, equity, quality of life and followed by economic prosperity. In contrast, as shown in table 38, Government considers as priority environmental stewardship, quality of life, equity, economic prosperity, growth management, finance and then mobility. All these results are useful due that the CI and CR of both table fix in with the consistency value range established.

Table 38. Government – Major Criteria's weighting

	M	F	GM	EP	ES	QL	E	Weighting	Ranking
M	1	1/2.38	1/3.11	1/2.45	1/2.56	1/2.72	1/1.87	0.062	7
F	2.38	1	1/1.07	1/1.72	1/2.19	1/1.31	1/1.94	0.109	6
GM	3.11	1.07	1	1/1.30	1/1.66	1/1.60	1/1.30	0.128	5
EP	2.45	1.72	1.30	1	1/1.64	1/1.39	1/1.13	0.148	4
ES	2.56	2.19	1.66	1.64	1	1.39	1/1.05	0.206	1
QL	2.72	1.31	1.60	1.39	1/1.39	1	1.85	0.189	2
E	1.87	1.94	1.30	1.13	1.05	1/1.85	1	0.159	3
Lambda: 3.189, C.I.:0.02, C.R.:0.02									
M: mobility, F: finance, GM: growth management, EP: economic prosperity, ES: environmental stewardship, QL: quality of life, E: equity.									

Source: This research data

Table 39. Overall Assessment- Major Criteria's Weighting

	M	F	GM	EP	ES	QL	E	Weighting	Ranking
M	1	1/1.92	1/1.75	1/1.39	1/1.08	1.07	1.02	0.113	7
F	1.92	1	1.23	1.61	1.32	1.93	1.40	0.204	1
GM	1.75	1/1.23	1	1.02	1/1.25	1.27	1.16	0.152	2
EP	1.39	1/1.61	1/1.02	1	1/1.22	1.37	1.28	0.144	4
ES	1.08	1/1.32	1.25	1.22	1	1.01	1.27	0.151	3
QL	1/1.07	1/1.93	1/1.27	1/1.37	1/1.01	1	1.23	0.120	5
E	1/1.02	1/1.40	1/1.16	1/1.28	1/1.27	1/1.23	1	0.118	6
Lambda: 3.099, C.I.:0.00761, C.R.:0.00761									
M: mobility, F: finance, GM: growth management, EP: economic prosperity, ES: environmental stewardship, QL: quality of life, E: equity.									

And finally, at table 39, we have the assessment of the 3 stakeholder together. As shown in the table, in an overall point of view, the stakeholder would concern more about finance, growth management, environmental stewardship, economic prosperity, quality of life, equity and mobility.

4.3.2. Mobility

With the mobility factor, we wanted to define better which benefits gain is more appreciated by users of the Cross Strait direct flight. As same as above, we have separate assessment by stakeholder and ending with a group assessment. The purpose is to see the opinion of each industry in an individual point of view and then, in a group point of view.

In the airlines industry, respondents take more emphasis in the "travel time saving" with a weighting level of 0.319. Following the travel time saving, respondents desire high reliability, vehicle operating and ownership and the last one, other user benefits.

Table 40. Airlines Industry – Mobility Weighting

	M1	M2	M3	M4	Weighting	Ranking
M1	1	1	1.89	1.50	0.319	1
M2	1	1	1.04	1.66	0.279	2
M3	1/1.89	1/1.04	1	1.38	0.224	3
M4	1/1.50	1/1.66	1/1.38	1	0.178	4
Lambda: 5.097, C.I.:0.02, C.R.:0.02						
M1: travel time saving, M2:reliability, M3:vehicle operating and ownership, M4: other user benefit						

Stakeholder strongly care about time saving especially in for airlines industries and technology industries due to the behavior and characteristics of their business, they require certain level of tight logistic performance. For airlines industries, saving in travel time represent a benefit for the wages paid to their labor especially pilot and air hostess. Also, shorten flight distance can represent less consumption of fuel. As shown in the figure 37. Mainland China and Taiwan airlines expenses, labor and fuel cost represent 48% above of their operating cost. Past studies suggested that lower cost in freight movement have a positive effect on all firms engaged in production, distribution, trade or retail sale of physical goods.

Figure 37. Mainland China (left side) and Taiwan (right side) airlines expenses
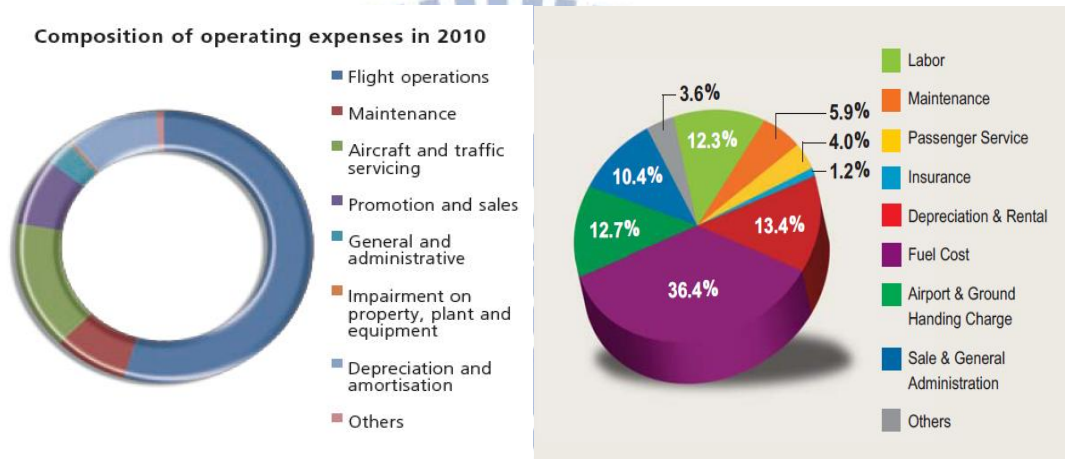
Source: Airlines Annual Report (2010)

On the other hand, high tech industry respondent appreciated more the reliability with a weighting of 0.419. Next, this industry care about the mobility, vehicle operating and ownership and other user benefits. High tech industry weights these criteria as follow 0.243, 0.186, and 0.154, respectively.

As many literature mentioned, users of transportation system value travel time reliability as well as saving since greater predictability in travel time help to reduce the cost associated with activity scheduling. Greater schedule reliability will have significant impacts in term of time gains. Therefore, allow high tech firms to manage their inventories and supply chains more efficiently. Increased in reliability reduce the requirement for buffer stock, inventory held to protect against delivery failure.

Table 41. High Tech Industry – Mobility Weighting

	M1	M2	M3	M4	Weighting	Ranking
M1	1	1/1.33	1.16	1.37	0.243	2
M2	1.33	1	2.86	2.66	0.416	1
M3	1/1.16	1/2.86	1	1.37	0.186	3
M4	1.37	1/2.66	1/1.37	1	0.154	4
Lambda: 7.572, **C.I.:**0.191, **C.R.:**0.200					
M1: travel time saving, M2:reliability, M3:vehicle operating and ownership, M4: other user benefit					

However, government considers more desire improving the "travel time saving" which weight it with 0.380. Then followed by the criteria "reliability" weighting it with 0.324; "vehicle operating and ownership", weight it with 0.185. And last, government considers the criteria "other user benefits", the level of a weight of 0.111.

Table 42. Government - Mobility Weighting

	M1	M2	M3	M4	Weighting	Ranking
M1	1	1.49	2.11	2.66	0.380	1
M2	1/1.49	1	2.36	2.79	0.324	2
M3	1/2.11	1/2.36	1	2.27	0.185	3
M4	1/2.66	1/2.79	1/2.27	1	0.111	4
Lambda: 4.378, **C.I.:**0.03, **C.R.:**0.03					
M1: travel time saving, M2:reliability, M3:vehicle operating and ownership, M4: other user benefit					

Regarding operation and ownership of vehicles, it involves real resource costs that are associated with using the transportation system. There are extensive literature that related vehicle operating and ownership with the changes in industries networks. For airlines is essential the selection of an airport point where their hub would be located. This means that after the Cross Strait direct air policy, carriers can planned better their hub and create better schedule of their fleet, employer and routing. Carriers that can provide better service can influence shipper business and logistics performance.

At last, the table 43 shows the overall assessment of the stakeholder's point of view for the criteria mobility. In an overall assessment, stakeholders appreciate the gain of mobility

benefits in the following order: reliability, travel time saving, vehicle operating and ownership, and other user benefit.

Table 43. Overall Assessment- Mobility Weighting

	M1	M2	M3	M4	Weighting	Ranking
M1	1	1.03	1.74	1.74	0.318	2
M2	1/1.03	1	2.06	2.36	0.345	1
M3	1/1.74	1/2.06	1	1.68	0.195	3
M4	1/1.74	1/2.36	1/1.68	1	0.142	4
Lambda: 4.452, **C.I.:**0.01, **C.R.:**0.01						
M1: travel time saving, M2:reliability, M3:vehicle operating and ownership, M4: other user benefit						

Source: This research data

4.3.3. Finance

As shown in the tables below, with the criteria finance, we try to capture what cost is more concerning for transportation users. In the case of airlines industry, they concern more about capital cost, followed by operating revenue, then, operating cost and finally, influence of finance on economy. However, high tech industry would concern more about operating revenue, operating cost, capital cost and at last, influence of finance on economy.

Figure 38. Mainland China (left side) and Taiwan (right side) airlines revenue
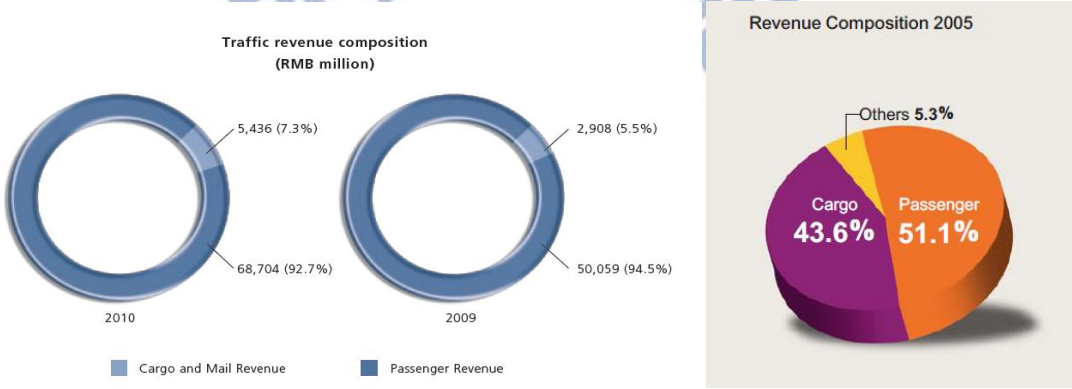
Source: Airlines Annual Report (2008)

The criteria "operating revenue" is relevant for this kind of industry due to the nature of their business. As carriers measure their profitability by the seat and weight load factor, it is very important for them to know what make their business. As shown in the figure 38.

Mainland China (left side) and Taiwan (right side) airlines revenue, passenger activity represents more than 90% of the total revenue gain by Mainland China airlines. On the other hand, Taiwanese airline's revenue represents almost half of cargo and half of passenger activities. However, high tech industries rely more in transportation to improve their logistic activities which allows the industries to reduce their cost and allow them to serve a wider market.

Besides operating revenue, the operating cost is another big concern especially for transportation industry as they rely heavily in petroleum and qualified professional. As mentioned in figure 37. Mainland China (left side) and Taiwan (right side) airlines expenses, labor and fuel are very important for airlines. On the other hand, many Taiwanese manufacturing established their factories in Mainland China are due to lower labor cost.

Table 44. Airlines Industry – Finance Weighting

	F1	F2	F3	F4	Weighting	Ranking
F1	1	1/2.68	1/3.46	1.57	0.134	3
F2	2.68	1	1.19	3.97	0.392	1
F3	3.46	1/1.19	1	3.76	0.380	2
F4	1/1.57	1/3.97	1/3.76	1	0.094	4
Lambda: 3.09, **C.I.:**0. 00776, **C.R.:**0.00776						
F1: operating cost, F2:capital cost, F3:operating revenue, F4: influence of finance on economy						

Source: This research data

Table 45. High Tech Industry – Finance Weighting

	F1	F2	F3	F4	Weighting	Ranking
F1	1	1.64	1/1.58	3.14	0.314	2
F2	1/1.64	1	1/1.30	1.49	0.211	3
F3	1.58	1.30	1	2.39	0.349	1
F4	1/3.14	1.49	1/2.39	1	0.126	4
Lambda: 4.191, **C.I.:**0.03, **C.R.:**0.03						
F1: operating cost, F2:capital cost, F3:operating revenue, F4: influence of finance on economy						

Source: This research data

On the other hand, government would concern about operating revenue, influence of finance on economy, operating cost, and capital cost. Based on government's respondent, they

weight the criteria "operating revenue" with 0.354. Subsequently, governments weight the criteria "influence of finance on economy" with 0.286. Next, the criteria "operating cost" with 0.197, and capital cost, weight it with 0.163.

Table 46. Government – Finance Weighting

	F1	F2	F3	F4	Weighting	Ranking
F1	1	1.17	1/1.60	1/1.55	0.197	3
F2	1/1.17	1	1/2.76	1/1.43	0.163	4
F3	1.60	2.76	1	1.07	0.354	1
F4	1.55	1.43	1/1.07	1	0.286	2
Lambda: 3.312, C.I.:0.01, C.R.:0.01						
F1: operating cost, F2:capital cost, F3:operating revenue, F4: influence of finance on economy						

Table 47. Overall Assessment – Finance Weighting

	F1	F2	F3	F4	Weighting	Ranking
F1	1	1/1.07	1/2.05	1.36	0.213	3
F2	1.07	1	1/1.53	1.50	0.241	2
F3	2.05	1.53	1	1.99	0.379	1
F4	1/1.36	1/1.50	1/1.99	1	0.168	4
Lambda: 3.452, C.I.:0. 00434, C.R.:0.00434						
F1: operating cost, F2:capital cost, F3:operating revenue, F4: influence of finance on economy						

In the overall assessment with all respondent's opinion put together, we get that stakeholders would put more emphasis in the "capital cost" with a weighting level of 0.241. The investment cost among different industries can vary according to the nature of their business. However, airlines industries, high technology industries and airport require a very high capital cost and the recovery of such investment may vary.

4.3.4. Growth Management

The criteria growth management tries to identify which population and employment distribution within the region is more desire for each stakeholder. Decision maker usually use the criteria "Growth Management" to measure the impact that new growth will going to have on a community and define the method by which that impact is mitigated.

As shown in the table below, airlines industry's respondents place additional importance in the criteria "employment" with a weighting level of 0.355. Following, consider the criteria "job and population in center", the level of a weight of 0.228. Third, respondents would consider the criteria "population", with a level of weight of 0.213. Last, respondents consider the criteria "job and housing balance", the level of a weight of 0.204.

Deregulation literature suggests that relaxing airlines regulation can impact economy growth and therefore would provide more jobs opportunities. Nevertheless, airlines deregulation can influence other area such as trade and tourism. This means that can boost those industries growth. On the other hand, as Taiwan government tries to attract firm to invest in Taiwan Trade Free Zones and Science Park, this can bring more job opportunities.

Table 48. Airlines Industry – Growth Management Weighting

	GM1	GM2	GM3	GM4	Weighting	Ranking
GM1	1	1/1.68	1/1.09	1.10	0.213	3
GM2	1.68	1	2.20	1.20	0.355	1
GM3	1.09	1/2.20	1	1	0.204	4
GM4	1/1.10	1/1.20	1	1	0.228	2
Lambda: 4.484, **C.I.:**0.025, **C.R.:**0.025						
GM1: population, GM2:employment, GM3:job and housing balance, GM4: job and population in center						

Source: This research data

Table 49. High Tech Industry – Growth Management Weighting

	GM1	GM2	GM3	GM4	Weighting	Ranking
GM1	1	1/1.92	1/1.03	1/1.09	0.196	3
GM2	1.92	1	1.66	2.04	0.383	1
GM3	1.03	1/1.66	1	1/1.58	0.190	4
GM4	1.09	1/2.04	1.58	1	0.231	2
Lambda: 3.083, **C.I.:**0.02, **C.R.:**0.02						
GM1: population, GM2:employment, GM3:job and housing balance, GM4: job and population in center						

Source: This research data

Nevertheless, high tech industry set the criteria ranking in as follow: employment, job and population in center, population and job and housing balance. The criteria "employment", high tech industry weights it with 0.383. Following, consider the criteria "job and population

in center", the level of a weight of 0.231. Third, respondents weight the criteria "population", with a level of weight of 0.196. Last, respondents consider the criteria "job and housing balance", the level of a weight of 0.190.

Past literature states that firms tend to located in the cities where there populations and employees where situated. Because of the environmental impact of having activities inside a city is very high and affect a large group of resident then firms used to move their operation farther into suburban or county sides. In contrast, high tech industries tend form clustering and located their business near each other. This would let employees from different companies to share and exchange working experience among them. The centralization and des-centralization of firms don't have a formal development pattern according to many literatures (Genevieve Giuliano, 1988).

Table 50. Government – Growth Management Weighting

	GM1	GM2	GM3	GM4	Weighting	Ranking
GM1	1	1/3.60	1/1.58	1/2.33	0.116	4
GM2	3.60	1	1/1.74	2.86	0.457	1
GM3	1.58	1.74	1	1.03	0.217	2
GM4	2.33	1/2.86	1/1.03	1	0.210	3
Lambda: 4.325, **C.I.:**0.02, **C.R.:**0.02						
GM1: population, GM2:employment, GM3:job and housing balance, GM4: job and population in center						

Source: This research data

Table 51. Overall Assessment – Growth Management Weighting

	GM1	GM2	GM3	GM4	Weighting	Ranking
GM1	1	1/2.21	1/1.20	1/1.33	0.174	4
GM2	2.21	1	1.78	1.75	0.387	1
GM3	1.20	1/1.78	1	1/1.24	0.205	3
GM4	1.33	1/1.75	1.24	1	0.235	2
Lambda: 3.207, **C.I.:**0. 00146, **C.R.:**0.00146						
GM1: population, GM2:employment, GM3:job and housing balance, GM4: job and population in center						

Source: This research data

On table 51 shows the government's position toward the growth management criteria. Respondents consider more important employment, job and housing balance, job and population in center and population. In the overall assessment, we get that stakeholders care

more about the criteria employment, job and population in center, job and housing balance and finally, population.

4.3.5. Economic Prosperity

Economic prosperity means overall economy, the economy is doing well and most people have sufficient income for essentials and perhaps a little extra. It means that businesses are hiring and jobs are relatively easy to get. The criteria, economic prosperity, try to identify which factors of transportation system that may tend to improve or degrade economic vitality have more important.

As shown in the table below, airlines industry place additional importance in the "cluster employment" with a weighting level of 0.413 then following by the criteria "low and high wage employment", with the level of a weight of 0.403. And at last, consider the criteria "freight related employment". But, high tech industry takes in account other criterion to weight the economic prosperity. For high tech industry, according to survey answer, it is more important "freight related employment"; followed by "low and high wage employment" and then by "cluster employment".

Table 52. Airlines Industry – Economic Prosperity Weighting

	EP1	EP2	EP3	Weighting	Ranking
EP1	1	1.14	1.89	0.403	2
EP2	1/1.14	1	2.60	0.413	1
EP3	1/1.89	1/2.60	1	0.184	3
Lambda: 3.675, **C.I.:**0.02, **C.R.:**0.02					
EP1: low and high wage employment, EP2:cluster employment, EP3:freight related employment					

Source: This research data

Table 53. High Tech Industry – Economic Prosperity Weighting

	EP1	EP2	EP3	Weighting	Ranking
EP1	1	1.27	1/2.25	0.261	2
EP2	1/1.27	1	1/1.64	0.248	3
EP3	2.25	1.64	1	0.491	1
Lambda: 3.007, **C.I.:**0.03, **C.R.:**0.03					
EP1: low and high wage employment, EP2:cluster employment, EP3:freight related employment					

Source: This research data

Carrier behavior toward serving a market is that if a market has demand, they will try to serve it. Rationale thinking suggests that high demand for freight related employment mean that high tech industries need movement of good. The need to move goods can be translate to growing in business activities. Both industries are afraid about new competitor entrants the Cross Strait market, however, the Cross Strait niche market is still immature; so there is still area where airlines and high tech companies haven't explore yet.

Table 54. Government – Economic Prosperity Weighting

	EP1	EP2	EP3	Weighting	Ranking
EP1	1	1/2.45	1/1.27	0.218	3
EP2	2.45	1	1.26	0.463	1
EP3	1.27	1/1.26	1	0.319	2
Lambda: 3.312, **C.I.:**0.02, **C.R.:**0.02					
EP1: low and high wage employment, EP2:cluster employment, EP3:freight related employment					

Source: This research data

Meanwhile, government desire would be different from airlines or high tech industry. As government wants to attract Taiwanese manufacturing back to Taiwan, they would also need to provide them an efficient transportation to get to their final market. At table 54, respondents take more priority to the criteria cluster employment, freight related employment and then, low and high wage employment.

Figure 39. Taiwan unemployment rate

Source: Trading Economics (2010)

Nowadays, Taiwan has an unemployment rate of 4.5% as shown in the figure 39. Taiwan -unemployment rate. A low unemployment rate means that inflows occur and this make up change in the labor force. The figure 40. Share of GDP of Agriculture, Industry and Services sectors shows the share of GDP between agriculture, services (transportation labor force is included) and industries sector (manufacturing labor force is included).

Figure 40. Share of GDP of Agriculture, Industry and Services sectors
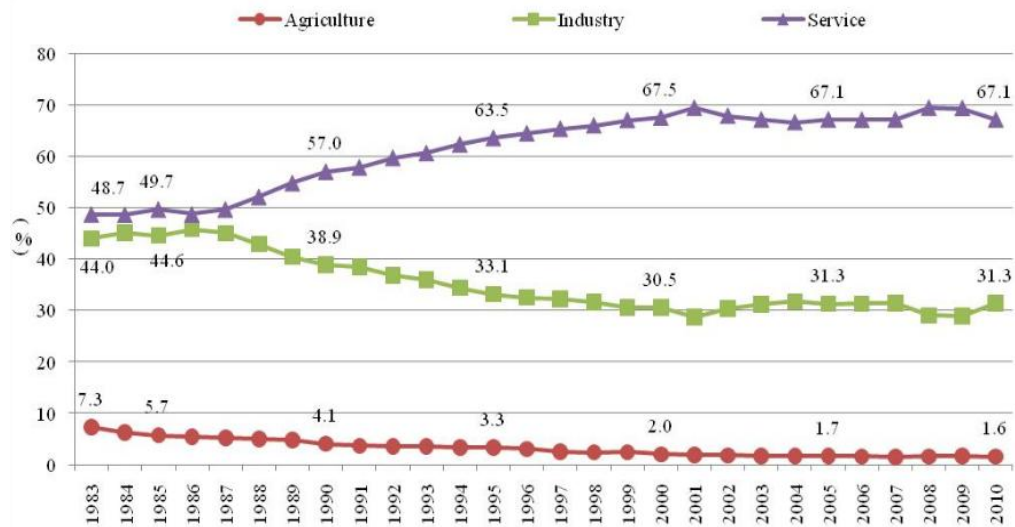
Source: Industrial Development Bureau, Ministry of Economic Affairs (2010)

In an overall assessment, airlines, high tech and government all together consider the priority as follows: the criteria cluster employment, freight related employment and then, low and high wage employment. Stakeholders ranking the criteria "cluster employment' with a level of 0.360; the criteria "freight related employment" with a level of 0.337 and then, the criteria " low and high wage employment" with a level of 0.303.

Table 55. Overall Assessment – Economic Prosperity Weighting

	EP1	EP2	EP3	Weighting	Ranking
EP1	1	1/1.11	1/1.19	0.303	3
EP2	1.11	1	1.14	0.360	1
EP3	1.19	1/1.14	1	0.337	2
Lambda: 4.312, **C.I.:**0.00428, **C.R.:**0.00428					
EP1: low and high wage employment, EP2:cluster employment, EP3:freight related employment					

Source: This research data

Even though the criteria "low and high wage employment is ranking in the third place, it doesn't mean is less important than above criteria. As aviation industries are gaining welfare, employees also want to gain that welfare. Trying to gain welfare from the deregulation may be the case that employees seek to press with labor strikes. As deregulation take place, firm can be threatened by other competitor.

4.3.6. Environmental Stewardship

The criteria environmental stewardship tries to determine which pollution has higher relevant for transportation users. As mentioned before, each industry may vary according to their business nature. As we know, airline firm is an industry that produces a high level of CO_2 and has a high level of noise pollution. On the other hand, high tech firm and airport require land space for their activities and their activities can affect communities living nearby them. Therefore, it is of concern of government to protect and regulation firm's activities. Besides, they need to tries find a way to mitigate the impact of aviation industries on common people.[32]

Airlines industry's respondents place additional importance in the "noise level" with a weighting level of 0.340. Secondly, consider the criteria "noise level", the level of a weight of 0.218 then following the criteria "energy usage", the level of a weight of 0.218. Next, the criteria "water quality" is considered by respondents with a level of a weight of 0.131. And last, stakeholder considers the criteria "resources land", the level of a weight of 0.109.

Table 56. Airlines Industry – Environmental Stewardship Weighting

	ES1	ES2	ES3	ES4	ES5	Weighting	Ranking
ES1	1	2.61	3.76	1.57	1.44	0.340	1
ES2	1/2.61	1	1/1.04	1/1.66	1/1.25	0.131	4
ES3	1/3.76	1.04	1	1/2.17	1/1.80	0.109	5
ES4	1/1.57	1.66	2.17	1	1/1.42	0.203	3
ES5	1/1.44	1.25	1.80	1.42	1	0.218	2
Lambda: 5.484, **C.I.:**0.01, **C.R.:**0.01							
ES1: air quality, ES2:water quality, ES3:resources land, GM4: energy usage, ES5:noise level							

Source: This research data

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[32] Refer to chapter 2.4.

Meanwhile, high tech industry's respondents place additional importance in the "resources land" with a weighting level of 0.266. Secondly, consider the criteria "energy usage", the level of a weight of 0.223 then following the criteria "noise level", the level of a weight of 0.201. Next, the criteria "water quality" is considered by respondents with a level of a weight of 0.186. And last, stakeholders consider the criteria "air quality", the level of a weight of 0.123.

Table 57. High Tech Industry – Environmental Stewardship Weighting

	ES1	ES2	ES3	ES4	ES5	Weighting	Ranking
ES1	1	1/2.33	1/1.70	1/1.58	1/1.54	0.123	5
ES2	2.33	1	1/1.87	1/1.37	1/1.17	0.186	4
ES3	1.70	1.87	1	1.47	1.03	0.266	1
ES4	1.58	1.37	1/1.47	1	1.40	0.223	2
ES5	1.54	1.17	1/1.03	1/1.40	1	0.201	3
Lambda: 4.370, **C.I.:**0.02, **C.R.:**0.02							
ES1: air quality, ES2:water quality, ES3:resources land, GM4: energy usage, ES5:noise level							

Source: This research data

However, government's respondents place additional importance in the "resources land" with a weighting level of 0.288. Secondly, consider the criteria "energy usage", the level of a weight of 0.214 then following the criteria "noise level", the level of a weight of 0.192. Next, the criteria "air quality" is considered by respondents with a level of a weight of 0.180. And last, stakeholders consider the criteria "water quality", the level of a weight of 0.125.

Table 58. Government – Environmental Stewardship Weighting

	ES1	ES2	ES3	ES4	ES5	Weighting	Ranking
ES1	1	1.26	1/1.94	1/1.44	1.46	0.180	4
ES2	1/1.26	1	1/2.39	1/1.80	1/1.49	0.125	5
ES3	1.94	2.39	1	1.42	1.15	0.288	1
ES4	1.44	1.80	1/1.42	1	1/1.05	0.214	2
ES5	1/1.46	1.49	1/1.15	1.05	1	0.192	3
Lambda: 4.443, **C.I.:**0.02, **C.R.:**0.02							
ES1: air quality, ES2:water quality, ES3:resources land, GM4: energy usage, ES5:noise level							

Source: This research data

As shown in the table below, overall respondents place additional importance in the "resources land" with a weighting level of 0.217. Secondly, consider the criteria "energy usage", the level of a weight of 0.221 then following the criteria "noise level", the level of a weight of 0.210. Next, the criteria "air quality" is considered by respondents with a level of a weight of 0.198. And last, stakeholders consider the criteria "water quality", the level of a weight of 0.154.

Table 59. Overall Assessment – Environmental Stewardship Weighting

	ES1	ES2	ES3	ES4	ES5	Weighting	Ranking
ES1	1	1.07	1/1.02	1/1.15	1.09	0.198	4
ES2	1/1.07	1	1/1.66	1/1.56	1/1.28	0.154	5
ES3	1.02	1.66	1	1.02	1/1.11	0.217	1
ES4	1.15	1.56	1/1.02	1	1/1.01	0.221	2
ES5	1/1.09	1.28	1.11	1.01	1	0.210	3
Lambda: 4.218, **C.I.:**0.00569, **C.R.:**0.00569							
ES1: air quality, ES2:water quality, ES3:resources land, GM4: energy usage, ES5:noise level							

Source: This research data

4.3.7. Quality of life

As transportation planning can improve the quality of life for the region's population such as carrier and shipper, including the benefits related to safety, human health and security. Then, the criterion quality of life tries to capture what improve in the quality of life is more important for each stakeholders.

Table 60. Airlines Industry – Quality of Life Weighting

	QL1	QL2	QL3	Weighting	Ranking
QL1	1	2.46	1.20	0.455	1
QL2	1/2.46	1	1/1.44	0.208	3
QL3	1/1.20	1.44	1	0.337	2
Lambda: 3.072, **C.I.:**0.01, **C.R.:**0.01					
QL1: accident cost saving, QL2:non motorized travel, QL3:redundancy					

Source: This research data

Firstly, airline's respondents situate further significance in the "accident cost saving" with a weighting level of 0.455. Secondly, respondents consider the criteria "redundancy", the

level of a weight of 0.337. Finally, consider the criteria "non motorized travel" with a weight level of 0.208.[33]

High tech industry's respondents consider more significance in the "redundancy" with a weighting level of 0.538. Next, respondents consider the criteria "accident cost saving", the level of a weight of 0.238. Finally, consider the criteria "non motorized travel" with a weight level of 0.224.[34]

Table 61. High Tech Industry – Quality of Life Weighting

	QL1	QL2	QL3	Weighting	Ranking
QL1	1	1.10	1/2.33	0.238	2
QL2	1/1.10	1	1/2.33	0.224	3
QL3	2.33	2.33	1	0.538	1
Lambda: 3.020, **C.I.:**0. 00098, **C.R.:**0.00098					
QL1: accident cost saving, QL2:non motorized travel, QL3:redundancy					

Source: This research data

On the other hand, government's respondents situate further significance in the "redundancy" with a weighting level of 0.572. Following, respondents consider the criteria "accident cost saving", the level of a weight of 0.302. Finally, consider the criteria "non motorized travel" with a weight level of 0.226.[35]

Table 62. Government – Quality of Life Weighting

	QL1	QL2	QL3	Weighting	Ranking
QL1	1	1.39	1/1.62	0.302	2
QL2	1/1.39	1	1/2.01	0.226	3
QL3	1.62	2.01	1	0.472	1
Lambda: 3.178, **C.I.:**0.00, **C.R.:**0.00128					
QL1: accident cost saving, QL2:non motorized travel, QL3:redundancy					

Source: This research data

Redundancy means reflection of the substitute facilities and/or services available to support travel demand if an event causes facilities and/or services to be damaged or destroyed. Then, for respondent, it is highly strong for carrier and shipper if some element of the transportation fail, they would have another choice to get to a market or serve a market.

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[33] Refer to chapter 2, part 2.1.4.
[34] Refer to chapter 2, part 2.1.4.
[35] Refer to chapter 2, part 2.1.4.

Besides concerning about redundancy, stakeholders do concern about the accident cost. The costs of accident risk are determined by the probability of an accident, severity of accidents and the costs that are incurred as a result of accidents. All of these accidents factors are influenced by the loadings and speeding on transportation facilities.[36]

As high tech industries goods are value as high value, this industries require carrier to provide a safety and confidentiality in the delivery of their cargo and have an accurate delivery time and place (Chaug-Ing Hsu et al, 2005).

Table 63. Overall Assessment – Quality of Life Weighting

	QL1	QL2	QL3	Weighting	Ranking
QL1	1	1.61	1/1.37	0.339	2
QL2	1/1.61	1	1/1.86	0.223	3
QL3	1/37	1.86	1	0.439	1
Lambda: 3.325, **C.I.:**0.00, **C.R.:**0.00305					
QL1: accident cost saving, QL2:non motorized travel, QL3:redundancy					

Source: This research data

In the overall assessment, respondents place further significance in the "redundancy" with a weighting level of 0.439. Secondly, respondents consider the criteria "accident cost saving", the level of a weight of 0.339. Finally, consider the criteria "non motorized travel" with a weight level of 0.223.[37]

4.3.8. Equity

With the criterion equity, it is seek to observe what distribution of transportation system prefer each stakeholder.

Airlines industry's respondents set down more important in the "personal and commercial user benefit" with a weighting level of 0.439. Secondly, consider the criteria "income distribution", the level of a weight of 0.285. Following by, consider the criteria "geographic distribution", the level of a weight of 0.155. Last, consider the criteria "environmental justice population benefit", the level of a weight of 0.120.

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[36] Refer to chapter 2, part 2.1.2.
[37] Refer to chapter 2, part 2.1.4.

Table 64. Airlines Industry – Equity Weighting

	E1	E2	E3	E4	Weighting	Ranking
E1	1	1/2.08	1/1.81	1/1.14	0.155	3
E2	2.08	1	1/2.05	2.96	0.285	2
E3	1.81	2.05	1	4.21	0.439	1
E4	1.14	1/2.96	1/4.21	1	0.120	4
Lambda: 4.193, **C.I.:**0.05, **C.R.:**0.05						
EP1: geographic distribution, EP2:income distribution, EP3:personal and commercial user benefit, E4: environmental justice population benefit						

Source: This research data

Carriers take more importance in how the government distributes the different route of the Cross Strait market among the different airlines that want to serve it. As Taiwan is located in an island, the only competitor for Cross Strait route for cargo shipment would be maritime vehicles or others airlines. Since Cross Strait air policy allows direct flight, shippers and air passengers also want to gain the benefit of the Cross Strait but having a reasonable distribution in transportation cost.[38]

Improvement in the transportation system can contribute to the growth of productivity in a firm. If the distribution of income is good enough then firms may think about change in their logistic performance or relocated their firm back to Taiwan or supply their firm with better goods from wider market. A good distribution of benefit can increase firms productivity, and followed can enhance the firm competitiveness.[39]

Table 65. High Tech Industry – Equity Weighting

	E1	E2	E3	E4	Weighting	Ranking
E1	1	1/2.22	1/2.02	2.33	0.209	3
E2	2.22	1	1/1.37	1.54	0.298	2
E3	2.02	1.37	1	1.58	0.338	1
E4	1/2.33	1/1.54	1/1.58	1	0.156	4
Lambda: 4.160, **C.I.:**0.07, **C.R.:**0.07						
EP1: geographic distribution, EP2:income distribution, EP3:personal and commercial user benefit, E4: environmental justice population benefit						

Source: This research data

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[38] Refer to chapter 2, part 2.1.4.

[39] ICF Consulting et al, Freight Benefit Cost Study: Capturing the full benefits of Freight Transportation Improvements: A non technical review of linkage and the benefit cost analysis framework, 2001.

High tech industry's respondents consider more relevant in the "personal and commercial user benefit" with a weighting level of 0.338. Secondly, consider the criteria "income distribution", the level of a weight of 0.298. Following by, consider the criteria "geographic distribution", the level of a weight of 0.209. Last, consider the criteria "environmental justice population benefit", the level of a weight of 0.156.

Table 66. Government – Equity Weighting

	E1	E2	E3	E4	Weighting	Ranking
E1	1	1	1/1.42	1/2.09	0.173	3
E2	1	1	1/2.19	1/3.23	0.140	4
E3	1.42	2.19	1	1/1.94	0.255	2
E4	2.09	3.23	1.94	1	0.432	1
Lambda: 4.072, **C.I.:**0.01, **C.R.:**0.01						
EP1: geographic distribution, EP2:income distribution, EP3:personal and commercial user benefit, E4: environmental justice population benefit						

Source: This research data

However, government's respondents would consider more important the criterion "environmental justice population benefit" with a weighting level of 0.432. Secondly, consider the criteria "personal and commercial user benefit", the level of a weight of 0.255. Following by, consider the criteria "geographic distribution", the level of a weight of 0.173. Last, consider the criteria "income distribution", the level of a weight of 0.140.

Table 67. Overall Assessment – Equity Weighting

	E1	E2	E3	E4	Weighting	Ranking
E1	1	1/1.61	1/1.68	1	0.190	4
E2	1.61	1	1/1.77	1.06	0.242	2
E3	1.68	1.77	1	1.40	0.348	1
E4	1	1/1.06	1/1.40	1	0.219	3
Lambda: 4.742, **C.I.:**0.01, **C.R.:**0.01						
EP1: geographic distribution, EP2:income distribution, EP3:personal and commercial user benefit, E4: environmental justice population benefit						

Source: This research data

In an overall assessment, overall respondents believe that it is more important the "personal and commercial user benefit" with a weighting level of 0.348. Secondly, consider the criteria "income distribution", the level of a weight of 0.242. Following by, consider the

criteria "environmental justice population benefit", the level of a weight of 0.219. Last, consider the criteria "geographic distribution", the level of a weight of 0.190.

4.3.9. Overall Assessment

Following, overall assessment by stakeholder would be presented; this would allow us to understand which factors are more important for each stakeholders. This is just for recall each stakeholder have different concerns than its counterpart because each industry has different needs and desire. Firstly, we have airlines industry assessment. Next, we are going to name only the first 10 most important factors for the each of the respondents. The factors are ranking as follow for airlines industry: (1) capital cost, (2) operating revenue, (3) employment, (4)cluster employment, (5)low and high wage employment, (6) job and population in center, (7) population, (8) job and housing balance, (9) air quality, and (10)travel time saving.

Next, we have the overall assessment done to High Tech Industry. And, we can appreciate that the priority for them are ranking as follow (1) operating revenue, (2) operating cost, (3) reliability, (4)capital cost, (5) travel time saving, (6) resource lands, (7) employment, (8) influence of finance on economy, (9) Personal and commercial user benefit, and (10)vehicle operating and ownership.

In contrast, government ranked the factors as follow (1) Resources land, (2) Redundancy, (3) Environmental justice population benefit, (4) Energy usage, (5) Cluster employment, (6) Noise level, (7) employment, (8) Air quality, (9) Accident cost saving, and (10) Operating revenue. However, when the assessment of all the stakeholder are putting together, we can have the following factor ranking (1) Operating revenue, (2) Employment, (3) Energy usage, (4) Resources land, (5) Cluster employment, (6) Noise level, (7) Freight related employment, (8) Air quality, (9) Capital cost, and (10) Low and high wage employment.

Table 68. Airlines Industries - Overall Assessment

Criteria	Weighting	Sub-criteria	Weighting	Overall Weighting	Ranking
Mobility	0.105	Travel time saving	0.319	0.040	10
		Reliability	0.279	0.035	11
		Vehicle operating and ownership	0.224	0.028	15
		Other user benefit	0.178	0.022	20
Finance	0.263	Operating cost	0.134	0.034	12
		Capital cost	0.392	0.100	1
		Operating revenue	0.380	0.097	2
		Influence of finance on economy	0.094	0.024	18
Growth Management	0.192	Population	0.213	0.044	7
		Employment	0.355	0.073	3
		Job and housing balance	0.204	0.042	8
		Job and population in center	0.228	0.047	6
Economic Prosperity	0.187	Low and high wage employment	0.403	0.069	5
		Cluster employment	0.413	0.071	4
		Freight related employment	0.184	0.032	13
Environmental Stewardship	0.108	Air quality	0.340	0.041	9
		Water quality	0.131	0.016	23
		Resources land	0.109	0.013	24
		Energy usage	0.203	0.024	19
		Noise level	0.218	0.026	16
Quality of life	0.069	Accident cost saving	0.455	0.026	17
		Non motorized travel	0.208	0.012	25
		Redundancy	0.337	0.020	21
Equity	0.076	Geographic distribution	0.155	0.010	26
		Income distribution	0.285	0.019	22
		Personal and commercial user benefit	0.439	0.029	14
		Environmental justice population benefit	0.120	0.008	27
Overall airline assessment inconsistency: 0.02					

Source: This research data

Table 69. High Tech Industries - Overall Assessment

Criteria	Weighting	Sub-criteria	Weighting	Overall Weighting	Ranking
Mobility	0.216	Travel time saving	0.243	0.047	5
		Reliability	0.416	0.080	3
		Vehicle operating and ownership	0.186	0.036	10
		Other user benefit	0.154	0.030	16
Finance	0.286	Operating cost	0.314	0.095	2
		Capital cost	0.211	0.064	4
		Operating revenue	0.349	0.106	1
		Influence of finance on economy	0.126	0.038	8
Growth Management	0.110	Population	0.196	0.021	20
		Employment	0.383	0.041	7
		Job and housing balance	0.190	0.020	21
		Job and population in center	0.231	0.025	18
Economic Prosperity	0.083	Low and high wage employment	0.261	0.016	24
		Cluster employment	0.248	0.016	25
		Freight related employment	0.491	0.031	15
Environmental Stewardship	0.116	Air quality	0.123	0.020	22
		Water quality	0.186	0.030	17
		Resources land	0.266	0.043	6
		Energy usage	0.223	0.036	11
		Noise level	0.201	0.033	12
Quality of life	0.088	Accident cost saving	0.238	0.015	26
		Non motorized travel	0.224	0.014	27
		Redundancy	0.538	0.033	13
Equity	0.101	Geographic distribution	0.209	0.023	19
		Income distribution	0.298	0.033	14
		Personal and commercial user benefit	0.338	0.037	9
		Environmental justice population benefit	0.156	0.017	23
Overall shipper assessment inconsistency: 0.02					

Source: This research data

Table 70. Government - Overall Assessment

Criteria	Weighting	Sub-criteria	Weighting	Overall Weighting	Ranking
Mobility	0.062	Travel time saving	0.380	0.024	18
		Reliability	0.324	0.021	21
		Vehicle operating and ownership	0.185	0.012	26
		Other user benefit	0.111	0.007	27
Finance	0.109	Operating cost	0.197	0.024	19
		Capital cost	0.163	0.020	22
		Operating revenue	0.354	0.043	10
		Influence of finance on economy	0.286	0.035	13
Growth Management	0.128	Population	0.116	0.013	25
		Employment	0.457	0.050	7
		Job and housing balance	0.217	0.024	19
		Job and population in center	0.210	0.023	20
Economic Prosperity	0.148	Low and high wage employment	0.218	0.027	16
		Cluster employment	0.463	0.058	5
		Freight related employment	0.319	0.040	11
Environmental Stewardship	0.206	Air quality	0.180	0.050	8
		Water quality	0.125	0.035	14
		Resources land	0.288	0.081	1
		Energy usage	0.214	0.060	4
		Noise level	0.192	0.054	6
Quality of life	0.189	Accident cost saving	0.302	0.047	9
		Non motorized travel	0.226	0.035	15
		Redundancy	0.472	0.074	2
Equity	0.159	Geographic distribution	0.173	0.025	17
		Income distribution	0.140	0.020	24
		Personal and commercial user benefit	0.255	0.037	12
		Environmental justice population benefit	0.432	0.062	3
Overall government assessment inconsistency: 0.02					

Source: This research data

Table 71. Overall Assessment

Criteria	Weighting	Sub-criteria	Weighting	Overall Weighting	Ranking
Mobility	0.113	Travel time saving	0.318	0.035	16
		Reliability	0.345	0.038	14
		Vehicle operating and ownership	0.195	0.022	24
		Other user benefit	0.142	0.016	27
Finance	0.204	Operating cost	0.213	0.039	13
		Capital cost	0.241	0.044	9
		Operating revenue	0.379	0.069	1
		Influence of finance on economy	0.168	0.031	17
Growth Management	0.152	Population	0.174	0.023	23
		Employment	0.387	0.051	2
		Job and housing balance	0.205	0.027	21
		Job and population in center	0.235	0.031	18
Economic Prosperity	0.144	Low and high wage employment	0.303	0.041	10
		Cluster employment	0.360	0.049	5
		Freight related employment	0.337	0.046	7
Environmental Stewardship	0.151	Air quality	0.198	0.046	8
		Water quality	0.154	0.036	15
		Resources land	0.217	0.050	4
		Energy usage	0.221	0.051	3
		Noise level	0.210	0.048	6
Quality of life	0.120	Accident cost saving	0.339	0.031	19
		Non motorized travel	0.223	0.021	26
		Redundancy	0.439	0.041	11
Equity	0.118	Geographic distribution	0.190	0.022	25
		Income distribution	0.242	0.028	20
		Personal and commercial user benefit	0.348	0.040	12
		Environmental justice population benefit	0.219	0.025	22

Overall government assessment inconsistency: 0.01

Source: This research data

V. Conclusions and Recommendation

5.1. Conclusion

This research study investigate the many ways that government policy decisions have affected (or could affect) the freight system. Policies can relax or restrict freight transportation of having a good logistics and therefore would impact on their services quality. As freight transportation become faster and more reliable, hence more predictable, the flow of good and the stocking of good can be managed more efficiently. In other words, relaxing policies would allow firms to reorganize their logistic and consequently can help firms to maximize profit benefits. The improvements in freight transportation logistics can help to increase the productivity of manufacturing, and distribution in many ways when they decide to reorganize their industries performance.

In a general way, transportation system improvement can spread reductions in cost and gains in productivity through all the economic sectors that produce or distribute good. Improvement in transportation policy and/or planning can be expected to have important economic effects on carrier's performance, shipper's performance and the whole region economy.

This research study seeks to figure out the benefits generated by opening Cross Strait direct air transportation. Improvement in airspace-freight carriage is one of the ways that government can make a truly valuable contribution to the efficiency of national economy. Therefore, benefit-cost analysis is used to estimate and evaluate the benefits generated by opening Cross Strait direct air transportation.

With the signing of the Cross Strait Direct Air Transportation Agreement, many restrictions related to air transportation was relaxed allowing airlines and carriers to provide direct flight between China and Taiwan. This research study tries to observe the effects on the cost and the productivity on Taiwanese businesses, carriers (Airlines industries) and shippers (High Tech industries). With the information provided by the different stakeholder in the survey questionnaire would help to understand which factors are more important for them. This would help to analyze the benefits produce across different segments of the population, which allows the decision-makers to understand how the benefits from opening direct air transportation between Mainland China and Taiwan are distributed among the population.

According to the ICF Consulting and HLB Decision Economic (2001), there are different kinds of effects that may occur from freight-transportation improvement. They divided improvement of transportation effect into three-order benefit such as:

1. First-order Benefits

They state that immediate cost reductions to carriers and shippers would be gained, also, including gains for shippers from the reduction of transit times and increased schedule reliability. However, transit times may affect shipper in-transit costs such as for spoilage, and scheduling costs such as for inter-modal transfer delays and port clearance.

Furthermore, effects on carrier included reduced vehicle operating times and reduced costs through optimal routing and fleet configuration.

2. Second-order Benefits

Based on ICF Consulting and HLB Decision Economic studies, they state that reorganization-effect could be gains from improving in industries logistics performances.

Reorganization effects within the different aviation industries would be not going to be similar, as for example, carrier's improvement would be reflected in their hub and spoke network, and services quality. On the other hand, shipper improvements included inventory, stock location, network, and service levels.

3. Third-order Benefits

In addition to reorganization effects, others benefits would be gains such as improved products, new products, or some other change.

4. Other Effects

According to ICF Consulting and HLB Decision Economic, there are others effects that are not considered as benefits according to the strict rules of benefit-cost analysis, but may still be of considerable interest to policy-makers. Other effects could be increases in regional employment or increases in rate of growth of regional income. There are a number of effects that may be of interest to citizens and to decision makers but are not benefits to society as reckoned by economic theory. Such effects might include regional redistribution of income, regional employment effects, impacts on land values, or other effects.

Based on the respondent questionnaire, according to the overall assessment, the most important factors are ranking as follow: (1) Operating revenue, (2) Employment, (3) Energy usage, (4) Resources land, (5) Cluster employment, (6) Noise level, (7) Freight related employment, (8) Air quality, (9) Capital cost, and (10) Low and high wage employment.

Based on the ranking intensity, we can conclude that due to the business nature, aviation industries are very sensitivity to the investment cost because they need a very high capital investment. On the other hand, freight related employment and cluster employment has a close relationship between them. The growth of high tech industries can help airlines activities growth because as high tech products demands increase; there would be a need to move goods from one place to another. By this way, freight related would be impact with the growth.

In short, improvement in transportation system would influence directly and indirectly economic activities. The effect at all level are different therefore when industries really rely on the policy, they would seek to for internal change in their development pattern such as location, distribution, business network, or logistic performance.

5.2. Managerial Implication

This study had come up that the introduction of Air Policy might change aviation industries performance. Airline Deregulation usually brings immediate welfare to airlines and users, however, air policy could bring negative impact to carrier as competitors increase in the market. As airlines could provide better services, they would be capable to attract new customers.

This study has proven that aviation industries have several weaknesses that government needs to care more about. The distribution system is very complex and have many different stakeholder involved in it; however, none of them have complete responsibility of the whole logistic system. Therefore, government plays an essential role in forecasting the limitation of transportation capacity, infrastructure inefficiencies, environmental pollution and social cost.

After investigate aviation industries behavior and Air Policy effects, there are some suggestion for aviation industries would be provided below.

Suggestion for the different stakeholders:

A suggestion for government is that they should pay more attention in their forecasting and planning of capacity demand. As government plays a significant function in the freight transportation supply chain, they should develop better mode of planning and forecasting transportation system capacity demand.

On the other hand, suggest carrier to form group and have agreement with Mainland China airlines. The Cross Strait Air Policy only allows Mainland China and Taiwan airlines to have direct flight between both sides. However, only several airport at Mainland where opened for Taiwanese airlines to call at them. Asides, Mainland China has domestic air regulation in which the markets are served by specific Chinese airlines. As suggestion for Taiwanese carriers is to make alliance and partnership with Mainland China airlines, by this way, Taiwanese airlines can provide better services and complete freight flight connection for their customers.

Besides, as the implementation of the Cross Strait Air Policy is still recent, some services provided by carrier would constrain some expectation of shipper about services quality and reliability. Therefore, I would suggest shippers to meet and test carrier's services quality, first. After ensured that carrier meet their necessity, shipper could strength their relationships.

This study is a contribution to the literature on the Impacts of Cross Strait Direct Air Policy with a specific focus on Taiwanese's aviation industries. There still needs to done more research on this topic, due to the fact that the Cross Strait Direct Air Policy is not totally mature and the existing literature on this topic is still limited.

5.3. Limitation of Study

This research study has several limitations that should be considered for future research. First of all, this research topic is very extensive. As the research topic is very large, study of the effect of Direct Air Policy on aviation industries wasn't analyzed very deeply.

Secondly, the size sample and diversity of respondent could constrain the analysis of the impact of Air Policy on carriers, high tech industries and society. As the size sample and survey's respondent collected were few, the results are not strong enough for proving the real desire and concerning of airlines industries, high tech industries and government.

Another constrained point that needs to highlight is the job position and the knowledge that each respondent have on Cross Strait Air Policy, their own industries and the demand of their customers.

For future research, I would suggest add more number of companies and job's position diversity. The diversity of respondent would help to establish clearly the needs among the industries in study. Furthermore, due to the size of this study, it can be used as preliminary

research which can be duplicated with a much larger sample volume to observe if the outcome remains the similar even when the quantity of respondents increases.

5.4. Suggestions on Future Research

For future research of this topic, I suggested some studies focus. One suggestion for future research, it is to add more diversity of industries to the study of the effect of Air Policy. By adding more industries in the research study could establish the full impact of Air Policy on all the economic sectors.

Otherwise, second suggestion for future research, it is to study only one industry. The contribution of studying only one industry is that the effect and results of Air Policy could be study more deeply. Researcher could analyze more profoundly the evolution of the industry and develop more specific strategic for them. And if the researchers have interest in passenger flight, the third suggestion, it is to study the impact that Cross Strait Air Policy has on air passenger market.
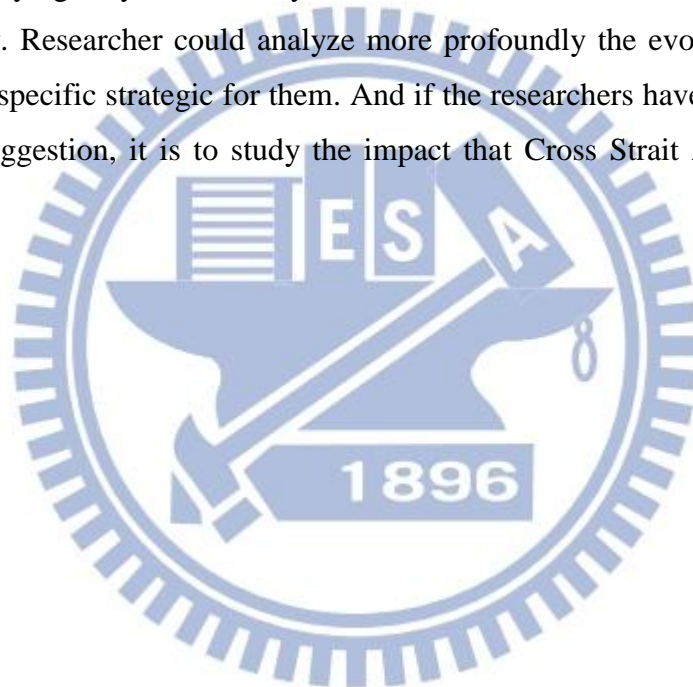
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Research Criteria

Connotation of the effects of having direct air transportation between Mainland China and Taiwan on Taiwanese aviation industries:

Mobility: This criterion wants to capture the benefits of the users

(M1)Travel Time Savings: many studies have established that the value of travel time savings is linked with the wages paid to drivers plus the time cost of cargo inventory for commercial vehicles (auto, bus, vessel, and aircraft).

(M2)Improved Reliability Benefits: greater predictability in travel time reduces the costs associated with the scheduling of activities. Reliability: can allow shippers to have tighter control of delivery schedules and inventories all along the supply chain.

(M3)Vehicle Operating and Ownership Benefits: (operating cost) There is an extensive literature, for vehicles of all types, which can be used to relate changes in industries network (carrier: fleet, routing, scheduling, etc) & (shipper: inventory, warehouse, damage and loss, etc) in order to save cost.

(M4)Other User Benefits: (user cost) The paying of user fees can involve real resource costs (changes in travel behavior toward a less preferred mode, route, time of travel, etc.) that are above and beyond the user fee cash payments. User fees are treated as both a cost to the user and a benefit to the operator.

Finance: This criterion wants to capture the cost of the users

(F1)Operating Cost: economic resources required to operate facilities, products and services.

(F2)Capital Cost: economic resource required to make capital investment to facilities, products and services.

(F3)Operating Revenues: The revenues generated as part of the operations of the transportation improvements or programs. Revenue rise through payments made by buyer and transportation user.

(F4)Influence of Finance on the Economy: When transportation funds are not generated from user fees, broader tax instruments must be implemented in order to finance investments. These broader tax instruments have potential consequences on economic activity by distorting

non-transportation related economic decisions and displacing productive economic activity. This would bring in the increasing of general taxes to pay for the transportation investments

Growth Management: to assess the degree of the distribution of population and employment within the region.

(GM1)Population: number of person within the region, area, geographic. The centers, in the region, area, geographic, are intended to attract residents and businesses because of their proximity to services and jobs, a variety of housing types, access to regional amenities, high quality transit service, and other advantages. Centers in other Larger Cities also play an increasing role over time as places that accommodate growth. These centers provide local and regional services and amenities, and will become more significant secondary job centers.

(GM2)Employment: number of jobs within the region, area, geographic. Increased share of jobs in region, area, geographic is an important indicator of job opportunities and accessibility within the area.

(GM3)Jobs to Housing Balance: ratio of jobs to person by region, area. A jobs-person ratio closer to the regional ratio would imply that residents have close and improved access to job locations, minimizing the need to make long work commutes, or to make lengthy trips to meet daily needs.

(GM4)Population and Jobs in Centers: number of population and jobs within the regional growth center and manufacturing industrial center. The centers are intended to attract residents and businesses because of their proximity to services and jobs, a variety of housing types, and their access to regional amenities

Economic Prosperity: measure the potential impacts of the having direct Cross Strait air transportation on economic prosperity by measuring those parts of the transportation system that may tend to improve or degrade the economic vitality of the region.

(EP1)Benefits to Low-wage and High-wage Employment: Investments in the transportation infrastructure would improve multimodal accessibility and then improved ability to attract jobs in high wage and low wage job sectors from outside the region.

(EP2)Benefits to Cluster Employment: Changes in user benefits that accrue to parts of the region with high concentrations of employment in existing cluster industries. Investments in

the transportation infrastructure would improve multimodal accessibility to the jobs located in targeted clusters and then improved ability to attract jobs in the targeted clusters from outside the region.

(EP3)Benefits to Freight-Related Employment: Investments in the transportation infrastructure would improve accessibility to freight-related industries and then provide incentives for more freight to move through the region. Key locations of freight-related employment include ports, intermodal terminals, warehouse and distribution centers, and regional manufacturing and industrial centers.

Environmental Stewardship: want to evaluate if the carrier activities and shipper activities have the ability to reduce pollution levels, reduce the runoff caused by impervious surfaces, and retain natural resource lands.

(ES1)Vehicle and Stationary Emission Benefits (Air Quality): Vehicle and building use results in the production of various pollutants, each of which imposes costs in terms of property damage, human and environmental health. There has been extensive study of the effects of various pollutants on the mortality and morbidity of populations, and the damage done to plants and property.

(ES2)Impervious Surfaces (Water Quality): A key indicator of the health of the region's water resources is the amount of impervious surface across the region as whole. The frequency and intensity of peak hydrological flows and the volume of storm-water runoff all increase when we build more roads, buildings and parking lots. Higher levels of imperviousness are connected to elevated summer water temperatures and more polluted runoff entering streams and water bodies. The roads, buildings, and parkand ride lots in each transportation alternative indicate whether there are greater amounts of impervious surfaces contributing to greater amounts of runoff.

(ES3)Agriculture and Natural Resource Lands (Open Space): The pressure to develop agricultural and natural resource lands will increase as the development on land nearby increases. This pressure will increase the potential to lose agricultural and natural resource lands to development. This potential reduction in natural resource lands is seen as a injury to the environment.

(ES4)Energy Usage from Vehicle and Building Use: Buildings and vehicles consume fuel and electric energy to operate. Energy consumption contributes to greenhouse gases and other pollutants.

(ES5)Noise level

Quality of Life: There are numerous ways that transportation planning of carriers and shippers can improve the quality of life for the region's population, including benefits related to safety, human health, and security.

(QL1)Accident Cost Savings: The costs of accident risk are determined by the probability of an accident, severity of accidents and the costs that are incurred as a result of accidents. All of these factors are influenced by loadings and speeds on transportation facilities. Many literatures provide adequate guidelines on how to value mortality, morbidity and property loss consequences of accidents.

(QL2) Non-motorized Travel: As growth patterns provide more housing in proximity to employment and vice versa and as more pedestrian and bicycle facilities are provided, there are more opportunities for travelers to choose walking and biking as a preferred mode of travel. This will improve the health and well-being of travelers who choose to walk and bike more often.

(QL3)Redundancy: Redundancy is a reflection of the substitute facilities and/or services available to support travel demand if an event causes facilities and/or services to be damaged or destroyed. As a result, the redundancy measure will include the total amount of arterial and freeway lane miles for road users and the number of bus and rail service hours for transit users and number of flight and frequency for aircraft carrier. Redundancy measures can indicate the capacity of the system to support users (road, transit, and freight) if specific elements of the systems were to fail.

Equity: is an important criterion to many different audiences evaluating the transportation system.

(E1)Geographic Distribution of Benefits: Decision makers are interested in the way that benefits of transportation projects are distributed across the region. Some transportation improvements have very localized effects while others distribute benefits more broadly.

(E2)Income Distribution of Benefits: Decision makers are interested in the way that benefits of transportation projects are distributed across segments of society. Some transportation improvements have broad benefits to users of the transportation system while others may distribute benefits more narrowly to users with either higher or lower values of time, and thus incomes.

(E3)Distribution of Benefits to Personal and Commercial Users: Decision makers are interested in the way that benefits of transportation projects are distributed across classes of vehicles. Some transportation improvements have broad benefits to users of the transportation system while others may distribute benefits more narrowly to specific users, such as freight vehicles.

(E4)Benefits to Environmental Justice Populations: Decision makers are interested in the way that benefits of transportation projects are distributed across segments of society. Some transportation improvements have broad benefits to all users of the transportation system while others may distribute benefits more narrowly. This distributional issue relates to whether specific vulnerable populations benefit from transportation improvements. Environmental justice defines as populations with low income populations, different race, different color, different sex, national origin and other.
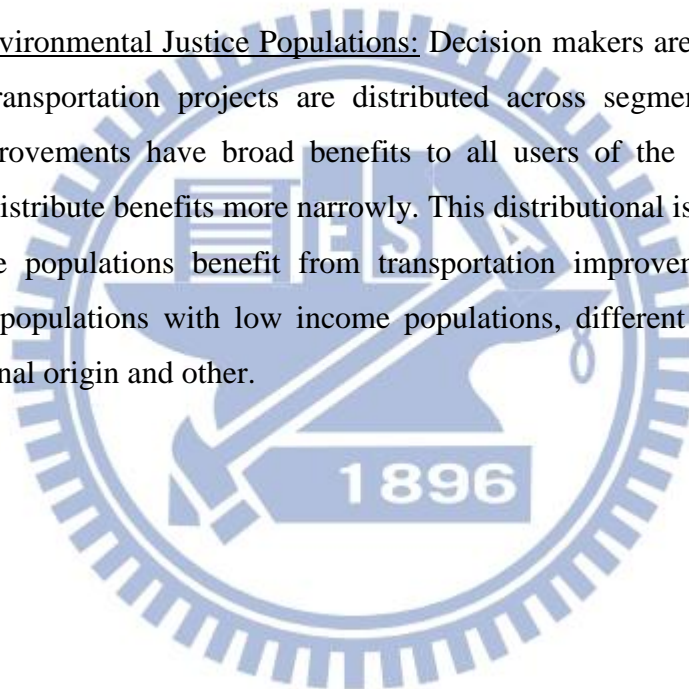
Dear participants:

This is an academic survey that seeks to observe the effects of having direct flight between Mainland China and Taiwan on Taiwanese aviation industries. Like in any transportation planning, investment, and/or improvement of transportation system, these projects would have an impact on their users, operator and community. The purpose of this research is to evaluate the effect that direct flight have on carriers (airlines), shipper (high tech industries) and the whole society.

The information provided in this questionnaire would help to come out with the benefits gained of having more efficient transportation. This questionnaire is only for academic research use. The information provided would not be release on separate publication. Please feel at ease to answer. Your feedback is very important for this study. Really appreciate you for taking the time to give cover to this survey.

Sincerely,

National Chiao Tung University Institute of Transportation and Traffic

Advisor: Sheu Jiuh Biing (許鉅秉 博士)

Student: Susana Tsang

Mail: tsang.susana@hotmail.com

Research Description:

This research study investigate the many ways that government policy decisions have affected (or could affect) the freight system. Policies can relax or restrict freight transportation of having a good logistics and therefore would impact on their services quality. As freight transportation become faster and more reliable, hence more predictable, the flow of good and the stocking of good can be managed more efficiently. In other words, policies allow firms to reorganize their logistic and consequently can help firms to maximize profit benefits. With improvement in freight transportation logistics, this can help increase the productivity of

manufacturing, and distribution in many ways when they decide to reorganize their industries performance.

In a general way, transportation improvement can spread reductions in cost and gains in productivity through all the economic sectors that produce or distribute good. Improvement in transportation policy and/or planning can be expected to have important economic effects on carrier's performance, shipper's performance and the whole region economy.

This research study seeks to figure out the benefits generated by opening Cross Strait direct air transportation. Improvement in airspace-freight carriage is one of the ways that government can make a truly valuable contribution to the efficiency of national economy. Benefit-cost analysis is used to estimate and evaluate the benefits generated by opening Cross Strait direct air transportation.

With the signing of the Cross Strait Direct Air Transportation Agreement, many restrictions related to air transportation was relaxed allowing airlines and carriers to provide direct flight between China and Taiwan. This research study tries to observe the effects on the cost and the productivity on Taiwanese businesses, carriers (Airlines industries) and shippers (High Tech industries). With the information provided by the different stakeholder, this would help analyze the benefits produce across different segments of the population, which allows the decision-makers to understand how the benefits from opening direct air transportation between Mainland China and Taiwan are distributed among the population.

Analytic Hierarchy Process model:

Please fill the basic Information of respondents:

Area of Profession of the respondent:

	Government
	Shipper (High Tech Industries)
	Carrier (Airlines)

Gender:

	Male
	Female

Professional Experience:

	Less than 2 years
	More than 2 year less than 4 years
	More than 4 year less than 6 years
	More than 6 year less than 8 years
	More than 10 years

Respondent's Job Position

	Administrative
	Logistic (import & export)
	Sale
	Manager
Others:	

Questionnaire instruction:

In this questionnaire survey, there are 7 criteria to evaluate the impact of having direct air transportation. Each criterion corresponds to measure the effect on carriers, shippers, and society. In the first part of the questionnaire, the objective is to evaluate the degree of important of judgment among each criterion. In each pairs of criteria, please select the degree of important of judgment depending on your professional area and knowledge.

(1) Which Air Policy effects are more appreciated by air transportation system users?

Criteria	Absolute important	Very important	Essential important	Weak important	Equal Important	Weak important	Essential important	Very important	Absolute important	Criteria
Mobility										Finance
Mobility										Growth management
Mobility										Economic prosperity
Mobility										Environmental stewardship
Mobility										Quality of life
Mobility										Equity
Finance										Growth management
Finance										Economic prosperity
Finance										Environmental stewardship
Finance										Quality of life
Finance										Equity
Growth management										Economic prosperity
Growth management										Environmental stewardship
Growth management										Quality of life
Growth management										Equity
Economic prosperity										Environmental stewardship
Economic prosperity										Quality of life
Economic prosperity										Equity
Environmental										Quality of life
Environmental										Equity
Quality of life										Equity

In the last part of the questionnaire, the objective is to evaluate the degree of important of judgment among each sub-criterion of the criteria. In each pairs of sub-criteria, please select the degree of important of judgment depending on your professional area and knowledge.

(2) Which benefits gain is more appreciated by users?

Mobility: This criterion wants to capture the benefits to transportation system users

Criteria	Absolute important	Very important	Essential important	Weak important	Equal Important	Weak important	Essential important	Very important	Absolute important	Criteria
Travel Time Savings										Reliability
Travel Time Savings										Vehicle Operating and Ownership
Travel Time Savings										Other User Benefits
Reliability										Vehicle Operating and Ownership
Reliability										Other User Benefits
Vehicle Operating and Ownership										Other User Benefits

(3) What cost is more concerning for users?

Finance: This criterion wants to capture the cost to transportation system users

Criteria	Absolute important	Very important	Essential important	Weak important	Equal Important	Weak important	Essential important	Very important	Absolute important	Criteria
Operating Cost										Capital Cost
Operating Cost										Operating Revenues
Operating Cost										Influence of Finance on the Economy
Capital Cost										Operating Revenues
Capital Cost										Influence of Finance on the Economy
Operating Revenues										Influence of Finance on the Economy

(4) Which population and employment distribution within the region is desire for stakeholder?

Growth Management: to assess the degree of the distribution of population and employment within the region.

Criteria	Absolute important	Very important	Essential important	Weak important	Equal Important	Weak important	Essential important	Very important	Absolute important	Criteria
Population										Employment
Population										Jobs to Housing Balance
Population										Population and Jobs in Centers
Employment										Jobs to Housing Balance
Employment										Population and Jobs in Centers
Jobs to Housing Balance										Population and Jobs in Centers

(5) Which factors of transportation system that may tend to improve or degrade economic vitality have more important?

Economic Prosperity: measure the potential impacts of the having direct Cross Strait air transportation on economic prosperity by measuring those parts of the transportation system that may tend to improve or degrade the economic vitality of the region.

Criteria	Absolute important	Very important	Essential important	Weak important	Equal Important	Weak important	Essential important	Very important	Absolute important	Criteria
Low-wage/High-wage Employment										Cluster Employment
Low-wage/High-wage Employment										Freight-Related Employment
Cluster Employment										Freight-Related Employment

(6) Which pollution has higher relevant?

Environmental Stewardship: want to evaluate if the carrier activities and shipper activities have the ability to reduce pollution levels, reduce the runoff caused by impervious surfaces, and retain natural resource lands.

Criteria	Absolute important	Very important	Essential important	Weak important	Equal Important	Weak important	Essential important	Very important	Absolute important	Criteria
Vehicle and Stationary Emission Benefits										Impervious Surfaces
Vehicle and Stationary Emission Benefits										Resource Lands
Vehicle and Stationary Emission Benefits										Energy Usage
Vehicle and Stationary Emission Benefits										Noise level
Impervious Surfaces										Resource Lands
Impervious Surfaces										Energy Usage
Impervious Surfaces										Noise level
Resource Lands										Energy Usage
Resource Lands										Noise level
Energy Usage										Noise level

(7) What improve in the quality of life is more important?

Quality of Life: There are numerous ways that transportation planning of carriers and shippers can improve the quality of life for the region's population, including benefits related to safety, human health, and security. The safety measure is the most straightforward, because we can enumerate the number of accidents by type and identify costs associated with these accidents.

Criteria	Absolute important	Very important	Essential important	Weak important	Equal Important	Weak important	Essential important	Very important	Absolute important	Criteria
Accident Cost Savings										Non-motorized Travel
Accident Cost Savings										Redundancy
Non-motorized Travel										Redundancy

(8) What distribution of transportation system prefers each stakeholder?

Equity: It is an important criterion to many different audiences evaluating the transportation system.

Criteria	Absolute important	Very important	Essential important	Weak important	Equal Important	Weak important	Essential important	Very important	Absolute important	Criteria
Geographic Distribution										Income Distribution
Geographic Distribution										Distribution of Benefits to Personal and Commercial Users
Geographic Distribution										Benefits to Environmental Justice Populations
Income Distribution										Distribution of Benefits to Personal and Commercial Users
Income Distribution										Benefits to Environmental Justice Populations
Distribution of Benefits to Personal and Commercial Users										Benefits to Environmental Justice Populations

親愛的受訪者您好:

這是一份關於中國大陸與台灣之間直航的學術研究;如同其他運輸規劃、投資、以及運輸系統的改善,這份計畫會影響企業經營者與社會大眾。這份研究的目的在於評估直航對於運送方(航空器業)、托運方(高科技產業)及整個社會。

問卷提供的資訊將會協助運輸更有效率;此問卷僅供學術研究,絕不公布任何相關資訊。回答時請不用感到任何壓力,您的回應對這份研究相當重要。誠摯感激您的作答。

Sincerely,

　　　國立交通大學交通運輸研究所

　　　指導教授:許鉅秉 博士

　　　學生:曾玉玲

　　　信箱:tsang.susana@hotmail.com

【Research Description】

這份研究試圖研究開放海峽兩岸間直航的效益。貨物運輸空間的改善是其中一項政府可實施來提升國家經濟效率的措施。本研究將使用「效益—成本分析」來評估開放海峽兩岸間直航之效益。

許多空運相關限制的放寬使得航空公司及運送方可提供兩岸之間的直航。本研究試圖研究對於台灣產業、運送方(航空企業)及托運方(高科技產業)成本與生產力的影響。根據不同利害關係人提供的資訊,可協助分析對於不同人群的效益,並幫助決策者了解海峽兩岸之間直航對於社會大眾之效益。

【Analytic Hierarchy Process Model】
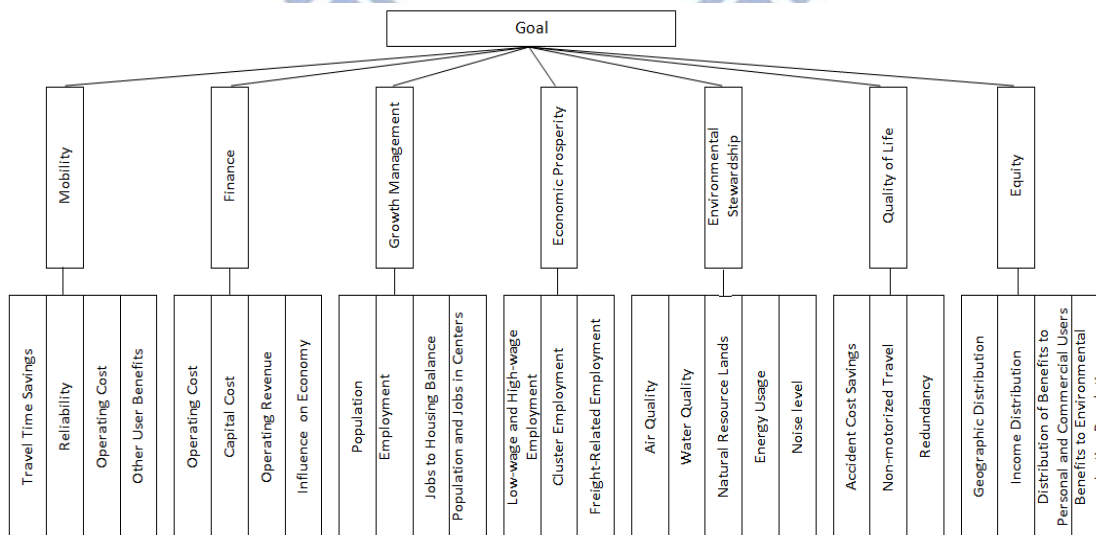
【Questionnaire Instructions& Example】

本問卷是在各層級間做各準則間重要程度的兩兩比較，受測者只需對問題中所提的兩個問項的相對重要性加以比較即可。若您認為左邊準則和右邊準則相比較，左邊準則為絕對重要，則在靠左邊的絕對重要空格下打勾，若是右邊為普通重要，則在靠右邊的普通重要空格下打勾，若當您認為左右兩準則有同等重要性，則於中間同等重要下打勾。

※範例：

以購置新腳踏車決策為例，當於選購新腳踏車時，通常會有許多考慮，如：成本，功能性、外觀樣式，在這三個準則下實施重要性比較，如下：

1. 成本及功能性比較：當認為成本較功能性為普通重要時，則在靠近成本的普通重要下打勾。

2. 成本及外觀樣式比較：當認為外觀樣式較成本為絕對重要時，於靠近外觀樣式的絕對重要打勾。

3. 功能性及外觀環境比較：當認為兩者有同等重要性時，則於同等重要性打勾。

考量 Criteria	絕對重要	極重要	普通重要	稍微重要	同等重要	稍微重要	普通重要	極重要	絕對重要	考量 Criteria
成本			v							功能性
成本									v	外觀樣式
功能性					v					外觀樣式

愈往左，左邊重要程度漸增　　　代表兩側準則同等重要　　　愈往右，右邊重要程度漸增

【Please fill the basic Information of respondents】

Area of Profession of the respondent:

	Government
	Shipper (High Tech Industries)
	Carrier (Airlines)

Gender:

	Male
	Female

Professional Experience:

	Less than 2 years
	More than 2 year less than 4 years
	More than 4 year less than 6 years
	More than 6 year less than 8 years
	More than 10 years

Respondent's Job Position

	Administrative
	Logistic (import & export)
	Sale
	Manager
Others:	

【問卷開始】

本問卷包括 7 個準則來評估直航運輸的影響。每個準則分別用以評估對運送方、托運方及社會的效果。

問卷第一部分的目的為評估每個準則的重要性。在每一對準則中，請根據您專業領域的知識判斷來選擇。

(1) 哪個準則對於您的行業是重要且感興趣的。

考量 Criteria	絕對重要	極重要	普通重要	稍微重要	同等重要	稍微重要	普通重要	極重要	絕對重要	考量 Criteria
機動性										財務性
機動性										公司成長性
機動性										總體經濟繁榮
機動性										環境保護

機動性										生活品質
機動性										社會公平
財務性										公司成長性
財務性										總體經濟繁榮
財務性										環境保護
財務性										生活品質
財務性										社會公平
公司成長性										總體經濟繁榮
公司成長性										環境保護
公司成長性										生活品質
公司成長性										社會公平
總體經濟繁榮										環境保護
總體經濟繁榮										生活品質
總體經濟繁榮										社會公平
環境保護										生活品質
環境保護										社會公平
生活品質										社會公平

問卷第二部分的目的為評估每項子準則的重要性。在每一對準則中，請根據您專業領域的知識判斷來選擇。

Mobility/機動性：此準則欲評估運輸系統使用者的效益。
(M1)Travel Time Savings: 旅行時間之節省：許多研究顯示旅行時間節省之價值是駕駛薪資加上商用車輛載貨之時間成本。
(M2)Improved Reliability Benefits: 改善之信賴度效益：更好的旅行時間預測可減少規劃相關活動之成本。信賴度：可使託運人對供應鏈之規劃及存貨有更有效之整控。
(M3)Vehicle Operating and Ownership Benefits: (operating cost) 車輛營運成本及所有人效益：(營運成本)許多文獻指出不同種類的車輛對路網架構(運送方：車隊、路線、規劃等；托運方：存貨、倉儲、損壞及損失等)有相關之影響以節省成本。
(M4)Other User Benefits: (user cost) (使用者成本)：使用者費用包含資源成本高或低於現金支付費用。使用者費用對於使用者來說是成本，對於營運者來說是效益。

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(2) 確認哪項效益是使用者最喜歡的。

考量 Criteria	絕對重要	極重要	普通重要	稍微重要	同等重要	稍微重要	普通重要	極重要	絕對重要	考量 Criteria
旅行時間之節省										運輸可靠度

考量 Criteria									考量 Criteria
旅行時間之節省									運輸工具營運成本
旅行時間之節省									運輸工具收費
運輸可靠度									運輸工具營運成本
運輸可靠度									運輸工具收費
運輸工具營運成本									運輸工具收費

Finance/財務：此準則欲評估運輸系統使用者之成本。

(F1)Operating Cost: 營運成本：經濟資源包括營運設施、產品及服務。

(F2)Capital Cost: 資金成本：經濟資源包括設施的投資、產品及服務。

(F3)Operating Revenues: 營運效益：產生之效益為運輸改善營運之一部分。效益將透過買者或運輸使用者所付之費用提高。

(F4)Influence of Finance on the Economy: 經濟上財務之影響：當運輸資本不是從使用者費用而來時，就必須由稅務制度來籌措資金。而稅務制度對非運輸之經濟決策及經濟生產活動的影響將造成經濟活動之潛在影響效果。這將會使得對於運輸投資之稅金提高。

(3) 使用者最關心哪項成本

考量 Criteria	絕對重要	極重要	普通重要	稍微重要	同等重要	稍微重要	普通重要	極重要	絕對重要	考量 Criteria
營運成本										資金成本
營運成本										盈利
營運成本										政府財政預算
資金成本										盈利
資金成本										政府財政預算
營運效益										政府財政預算

Growth Management/成長管理：此準則欲評估地區之人口及就業分配。

(GM1)Population: 人口：區域內之人口數。區域、範圍、地理位置之中心更吸引居民及商業，因為鄰近工作、各式各樣之房屋種類及地區福利設施之可及性、高品質之轉運服務等。其他大城市中心之重要性也隨著成長而日益增加。這些中心提供地區或區域服務及福利設施，且會成為第二重要之工作中心。

(GM2)Employment:就業：區域內之工作數目。工作成長是一範圍內工作機會與可及性之重要指標。

(GM3)Jobs to Housing Balance: 工作與住宅平衡：區域之工作與人口比例越接近指示居民有更近與更好的管道抵達工作地點，降低通勤成本或減少滿足生活所需之長程旅途。

(4) 哪一個人口和就業分布是利害關係人所想要的。

考量 Criteria	絕對重要	極重要	普通重要	稍微重要	同等重要	稍微重要	普通重要	極重要	絕對重要	考量 Criteria
人口										就業率
人口										工作與住宅平衡
人口										市中心之人口與工作數
就業率										工作與住宅平衡
就業率										市中心之人口與工作數
工作與住宅平衡										市中心之人口與工作數

Economic Prosperity/經濟繁榮：此準則欲藉由量測會影響一區域之經濟的運輸系統部分來評估兩岸間直航對經濟繁榮之可能影響。
(EP1)Benefits to Low-wage and High-wage Employment: 高薪與低薪就業率之效益：運輸基礎建設之投資將改善複合模式之可及性並提高區域外之高薪與低薪之吸引力。
(EP2)Benefits to Cluster Employment: 群集就業之效益：使用者效益之改變將造成現有群集產業就業率之高集中性。運輸基礎建設之投資會改善目標群集內之工作的複合模式可及性，並提高區域外群集工作之吸引力。
(EP3)Benefits to Freight-Related Employment: 貨運相關就業之效益：運輸基礎建設之投資將改善貨運相關企業之可及性，並刺激區域之貨物流動。貨運相關就業主要位置包括港口、聯運轉運站、倉儲、配送中心及區域生產與工業中心。

(5) 哪項運輸系統因素最重要會改善或是降低經濟力.

考量 Criteria	絕對重要	極重要	普通重要	稍微重要	同等重要	稍微重要	普通重要	極重要	絕對重要	
整體產業薪水高低										整體市場就業率

| 整體產業薪水高低 | | | | | | | | | 貨運相關就業市場 |
| 整體就業市場 | | | | | | | | | 貨運相關就業市場 |

Environmental Stewardship/環境管理：此準則欲評估運送與託運雙方之活動所降低汙染的程度、減少不透水表面造成的徑流以及保護自然資源土地之能力。

(ES1)Vehicle and Stationary Emission Benefits (Air Quality): 車輛及場站排放效益（空氣品質）：車輛和建築物產生的各種污染會造成財產損失，對人類健康與環境之衝擊。已有廣泛研究指出各種汙染的影響，包括死亡率以及對植物和財產之威脅。

(ES2)Impervious Surfaces (Water Quality): 不透水表面（水質）：區域之水資源品質指標是不透水表面的多寡。水流量高峰時及雨水徑流量增加時需要建造更多的道路、建築物以及停車場。高程度之不透水與夏季水溫之升高和更多的汙染徑流相關。每個交通替代道路之道路、建築物以及停車場代表著是否有更多的不透水表面造成更大量的徑流。

(ES3)Agriculture and Natural Resource Lands (Open Space): 植物和自然資源土地（開放空間）：發展農業和自然資源土地的壓力將隨著土地周遭的發展而增加。該壓力可能會影響農業及自然資源土地發展的成長。可能的自然資源土地減少對於環境是一種傷害。

(ES4)Energy Usage from Vehicle and Building Use: 車輛和建築物之能源使用：建築物和車輛所需之燃料與電力。能源消耗會造成溫室氣體與其他汙染物之生成。

(ES5)Noise level: 噪音程度

(6) 哪項污染最高度相關

考量 Criteria	絕對重要	極重要	普通重要	稍微重要	同等重要	稍微重要	普通重要	極重要	絕對重要	考量 Criteria
運輸工具及場站汙染 (空氣汙染)										水汙染
運輸工具及場站汙染 (空氣汙染)										土地資源
運輸工具及場站汙染 (空氣汙染)										能源消耗
運輸工具及場站汙染 (空氣汙染)										噪音汙染
水汙染										土地資源
水汙染										能源消耗
水汙染										噪音汙染
土地資源										能源消耗
土地資源										噪音汙染
能源消耗										噪音汙染

Quality of Life/生活品質：運送和託運雙方有許多運輸規劃方法可提高該區域人口之生活品質，包括安全、健康與保全。安全措施是最簡單的，因為可以按事故類型來辨別各項事故成本。最後找出道路和 **redundancy metrics** 來量測運輸系統的保全。

(QL1)Accident Cost Savings: 事故成本之節省：事故風險之成本由事故之機率決定，事故的嚴重程度和成本作為事故之結果。這些所有因素皆受運輸設施之載重與速度影響。許多文獻提供如何評估死亡率、發病率與事故發生之財產損失方法。

(QL2) Non-motorized Travel: 非機動性旅遊：隨著模式的成長提供了更多之就業，而隨著更多之行人與自行車設施，有更多機會提供旅客選擇步行或是騎自行車作為旅行模式。

(QL3)Redundancy: Redundancy 是反應當設施或服務受到破壞，替代設施或服務支援旅行需求之能力。因此 Redundancy 包括幹道數量和使用者之高速公路里程數、公車數量和轉運者之鐵路服務時數，以及航班數量和飛機運送之頻率。該指標可顯示當主要系統受到破壞，系統支援使用者(道路、轉運以及空運)之能力。(this survey refers to air redundancy)

(7) 哪項最重要可改善生活品質

考量 Criteria	絕對重要	極重要	普通重要	稍微重要	同等重要	稍微重要	普通重要	極重要	絕對重要	考量 Criteria
減少事故成本										不使用機動車輛旅遊
減少事故成本										替代設施支援能力
不使用機動車輛旅遊										替代設施支援能力

Equity/社會公平：社會公平是一項評估運輸系統對於各不同族群之重要指標。

(E1)Geographic Distribution of Benefits: 地理之效益分配：決策者對於分配運輸計畫效益至整個區域感到興趣。有些運輸改善相當本地化，這將廣泛地影響效益之分配。

(E2)Income Distribution of Benefits: 收入之效益分配：決策者對分配運輸計畫效益至社會各階層感到興趣。有些運輸系統改善對於運輸系統使用者有廣泛的好處，而其他人分配的利益可能因更高或更低之時間價值而更狹窄。

(E3)Distribution of Benefits to Personal and Commercial Users: 個人與商業用戶之效益分配：決策者對分配運輸計畫效益至各類車輛感到興趣。有些運輸改善對於運輸系統使用者有廣泛的好處，而其他對於特地使用者的好處可能較狹隘，例如貨運車輛。

(E4)Benefits to Environmental Justice Populations: 環境正義族群之效益：決策者對分配運輸計畫效益至社會各階層感到興趣。有些運輸改善對於運輸系統使用者有廣泛的好處，而其他分配的利益更窄。這種分配問題涉及弱勢族群是否從交通改善中受益。環境正義族群定義為低收入、不同種族、不同膚色、不同性別、民族血統和其他人群。

(8) 哪個運輸系統效益分配對利害關係人最好

考量 Criteria	絕對重要	極重要	普通重要	稍微重要	同等重要	稍微重要	普通重要	極重要	絕對重要	考量 Criteria
地理位置分布										收入分配
地理位置分布										利益分配 (相關產業 v.s.一般社會大眾)
地理位置分布										環境正義
收入分配										利益分配 (相關產業 v.s.一般社會大眾)
收入分配										環境正義
利益分配 (相關產業 v.s.一般社會大眾)										環境正義