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A destination selection model for long haul routes – The case of Taiwan-US

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ABSTRACT

This research utilizes multi-objective programming to build a long haul route selection model in order to find the most efficient and the best flight routes between Taiwan and the US. The results show that three potential routes, Boston, Dallas and Washington, should be added to the airlines' service destinations. In addition, if Chinese passengers are allowed to transfer to the US via Taiwan, then Newark, Atlanta, Chicago and Detroit should be included as additional potential routes for carriers. Therefore, this research encourages airlines to add these specific new routes to increase the air connectivity of Taiwan Taoyuan Airport.

1. Introduction

Taiwan Taoyuan International Airport (TPE) started to offer air service in 1979. With the economy booming in the 1980s and 1990s, TPE benefited from Taiwan's economic growth and enjoyed prosperous development for nearly two decades. However, when faced with increased competition from Asian countries and the political difficulties encountered in developing air routes, TPE gradually lost its strength as a hub and was replaced by neighboring airports such as those in Japan, Korea and China. This is the reason why, when a new government was elected in 2008, the Taoyuan Airport City Project became the flagship policy for promoting the Taiwan economy and TPE as well. In 2010, TPE was transformed from a government agency to a business organization, the Taoyuan International Airport Corporation (TIAC). To achieve the goal that the government has set for TPE, the new missions that have been proposed include TPE becoming one of the Air Hubs in East Asia, as well as being developed to accommodate O/D and transfer passengers.

Although TPE has greatly improved following the corporatization, it still faces challenges related to its route composition. According to TPE yearly statistics, passengers to and from China, Japan, and Hong Kong account for nearly 60% of total volume (see Fig. 1 for the details). Furthermore, more than half of the new routes added are the result of the opening up of cross-Strait direct flights between Taiwan and China. In other words, the increase in the number of passengers from 2010 to 2015 mostly represents short-haul and O/D flights. The development of long-haul flights and transfer passengers is still limited in TPE. In addition, according to the results of a study by Lin and Fu (2014), providing direct flights across the Taiwan Strait has significantly increased the accessibility of China from TPE, but the dependence of TPE on Chinese airports has also increased significantly. Although China will become the largest aviation market in the future, the punctuality of its scheduled flights is still a big issue. Furthermore, services between China and the US are limited. As a result, most Chinese passengers choose to transfer via Korea, Japan or Hong Kong when traveling to North America. Therefore, if the Chinese government lifts the ban on Chinese passengers transiting via Taiwan, this will provide a great opportunity for TPE. Therefore, this research utilizes multi-objective programming to build a long haul route selection model in order to find the most efficient or the best flight routes from Taiwan to the US. This model selects the combination of a set of destinations that will meet the requirement to achieve maximum revenue, while minimizing the cost.

2. Routes from Asia to the US

2.1. Services from Asian airports to the US

Following the deregulation of its domestic aviation market in

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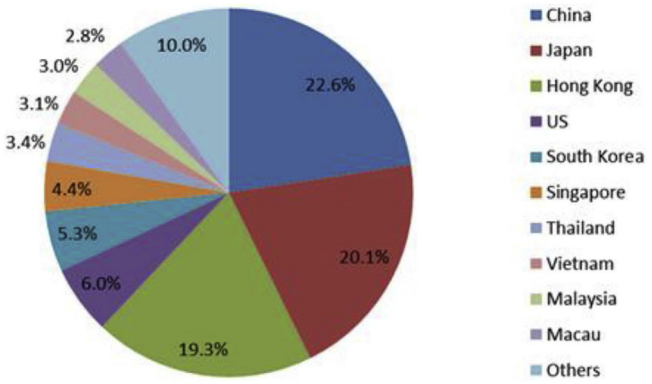

Fig. 1. Percentages from source countries in 2014.
Source: TPE yearly statistics.

1978, the US persuaded other nations to open up their air transport markets by means of Open Skies Agreements. The Netherlands was the first country to sign this kind of agreement with the US in 1978 (Chang et al., 2009). So far, there are 120 countries that have signed open skies agreements with the US. In the Asia-Pacific, countries such as Taiwan, Singapore, South Korea, Japan, Malaysia, Indonesia, Thailand, Brunei, Laos, India, Australia and New Zealand have all signed such agreements. The main characteristics of the Open Skies Agreements include the elimination of restrictions on capacity, route operating rights, and the flexibility to offer multiple designations (Chang et al., 2004).

As the US aviation policy in Asia in the past focused largely on Japan, good networks of Japan-US routes are now well established by both Japanese and US carriers. In 2008, South Korea joined the US Visa Waiver Program and this has resulted in a 35% increase in air traffic between South Korea and the US. In 2012, Taiwan officially joined the same program and the total inbound tourist figure has drastically increased by 42.4% (between 2012 and 2014) as a result of this scheme (see Fig. 2). It is believed that the US authority will implement the same scheme in other Southeast Asian countries due to the increased demand from Southeast Asian travelers transiting in Taiwan en route to the US that is being forecasted.

In the meantime, Korean Airlines is operating 11 routes from Seoul to US destinations (see Table 1). ANA, the Japanese carrier, is also flying from Japan to 11 US destinations. However, the 2 Taiwanese carriers, China Airlines and EVA Airways, are only serving up to 6 US destinations from Taiwan. China Airlines has joined the Skyteam alliance, whereas EVA Airways is now part of the Star alliance. These two carriers could cooperate with other Asian alliance partners to fly from Taiwan to more US cities by code sharing.

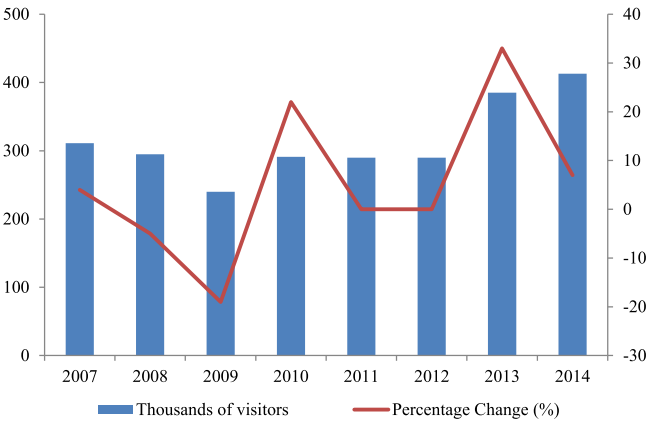

Fig. 2. Traffic between Taiwan and the US.

TPE currently has 158 flights per week to the US. This number of flights is far behind those from Hong Kong (250 flights), Japan (374 flights) and South Korea (346 flights) according to Table 2. As shown in Table 3, around 17%–19% of travelers travelled from Taiwan to the US by transiting in China, Hong Kong, South Korea and Japan. In addition, of the 19% (flying east) and 17% (flying west), the majority of travelers chose to transit in Japan, which consisted of 12.63% (flying east) and 10.97% (flying west), respectively, according to Table 3. This is most likely due to the high flight frequencies and larger number of destinations available from Japan to the US. In addition, Japan's Narita airport is seen to focus more on Asian airports, as these airports bring in passengers from Southeast Asia and China who prefer to transfer to the US in Japan. The limitation of flight destinations from Taiwan to the US has not only increased traveling time for passengers transiting to the US, but has also caused inconvenience to passengers.

2.2. Routes from China to the US

Under the 2007 Air Service Agreement between China and the US, passenger flights were to increase from 121 to 180 per week for each side in 2010 (Fu et al., 2012). According to statistics compiled by the US Department of Commerce, the annual traffic from China to the US exceeded two million passenger times in 2014, almost five times that for 2007 (see Fig. 3 for the details). It is expected that China will achieve air passenger traffic of one billion passenger times by 2022 and will become the largest aviation market globally (Kim et al., 2010). Although trade and passenger traffic between China and the US have been growing rapidly since the early 1990s, the China-US routes served by the Chinese carriers are still far behind the Korean and Japanese carriers (Fu et al., 2015a). The main reason is that China is conservative in regard to the liberalization of its air transportation and still imposes limitations on private airlines serving international routes (Fu et al., 2015b). On the other hand, some Asian airlines are keen to serve the Asian-US routes (see Table 4 for the details). As a result, around 40% of Chinese passengers transfer via South Korea to North America, and 28% via Japan (see Table 5). Among these Chinese passengers, around 23% fly from Shanghai, 21% from Beijing, 14% from Guangzhou, and 13% from Hong Kong. In terms of the different regions in China, studies have shown that around 42% of passengers from Northern China transfer via South Korea to North America, while 84% of passengers from Southern China and 47% of passengers from Central China transfer via Hong Kong to North America (Institute of Transport, 2015).

2.3. Discussion

Recently, the former US Transport Secretary John Byerly stated: “Expanding the number of international city-pairs to the US, encouraging innovative and affordable air service (such as long-haul, low-cost service) … should be top priorities for the US government”. He also remarked: “Since the late 1990s, it has been US policy to seek Open Skies agreements with essentially every country in the world. If I had to pick one country where Open Skies would make a huge difference, it would be China, where passenger demand has been bumping up against fixed limits on flight frequencies” (Routesonline, 2016). Due to no Open Skies Agreements having been reached between China and the US, destinations and flight frequency services are limited on the China-US routes (Fu et al., 2015a). Taiwanese carriers, by contrast, are already offering 55 routes between Taiwan and China. There will be massive

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