



Aviation subsidy policy and regional wellbeing: Important indicators from relevant stakeholders' perspectives

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ABSTRACT

A failure to adequately reconcile stakeholder interests and opinions can increase the probability of a failed aviation subsidy request or a loss of regional opportunity. This study, instead of arguing the importance and offering critiques of aviation subsidies, conducts a survey of stakeholders in New Zealand and Taiwan and uses fuzzy analytic hierarchy process to evaluate and prioritise key air transport activities and regional wellbeing indicators regarding the design and implementation of aviation subsidy policies in the early stage of the COVID-19 pandemic. The findings show that destination served, flight frequency, local business activities, medical treatment, and rapid hazard response were considered the key factors of aviation subsidies. Integrating economic and social wellbeing into subsidy policy design and implementation is highly necessary. The results provide useful insights for the development of aviation subsidy policies aimed at improving regional wellbeing in New Zealand and Taiwan during the post-COVID-19 era.

1. Introduction

According to contemporary evidence, transport has played a significant role in facilitating wellbeing (Delbosc, 2012). Air transport is a critical component of transportation, enhancing wellbeing by enabling a wider range of vacation destinations, fostering connections among far-flung families and friends, and expanding the market and supply areas for businesses, thereby facilitating deeper specialization and efficiency. It is generally accepted that air services to peripheral regions are not always commercially viable, leading to a demand for subsidy from governments (e.g. Donehue & Baker, 2012; Fageda et al., 2018; 2019; Merkert & O'Fee, 2013). Integrating specific wellbeing outcomes help governments to design and implement their aviation subsidy programmes efficiently. While there has been a good deal of recent debate about the efficacy, efficiency, and equity of such subsidy (e.g. Calzada & Fageda, 2014; Fageda et al., 2018; 2019), some research gaps are still to be filled. First, the aviation subsidy programmes in Australia, the European countries and the US have been widely researched (e.g. Baker et al., 2015; Fageda et al., 2018; Wittman et al., 2016) but not those in other countries. Secondly, there has been little discussion about aviation subsidies and regional wellbeing (Wu et al., 2020). Recent research has surveyed the perceived importance of aviation subsidies to the regions

and the contribution of aviation subsidies to smaller communities. They also endeavoured to address the perspectives of various stakeholders (e.g. airlines, air transport authorities, city council officials, regional airports and residents) and their motivations in procuring subsidised regional air services to inform better policy decisions (Donehue & Baker, 2012; Halpern & Bråthen, 2011; Özcan, 2014). These studies resulted in range of opinions about aviation subsidies but little discussion about the role of wellbeing outcomes play in aviation subsidy policy formation and their potential to inform subsidy policy changes.

Often a loose-knit group of interested stakeholders – those who believe their interests would be served by expanded (subsidised) air service – form a 'growth coalition' by commissioning aviation consultant or academics to generate a study arguing for increased air service. Some of these coalitions tend to consist of a disparate set of stakeholders from regional airports and airline managers to members of regional/local governments to leaders of the local business communities and staff from tourism groups. Academics and environmentalists also get involved. A failure to adequately reconcile stakeholder interests and opinions can increase the probability of a failed subsidy request and a lost regional opportunity.

Generally, government backed stakeholders who promote regional air travel and aviation activities are unlikely to speak against aviation

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subsidy policies (Özcan, 2014). However, their perspectives regarding the indicators considered in subsidy policy are still worth exploring. Therefore, this study, instead of arguing the importance and offering critiques of aviation subsidies, focuses on exploring key indicators being considered during the regional aviation subsidy policy forming and implementing processes. Previously, the most common approach to explore stakeholders' and policymakers' perspectives in terms of aviation subsidy is to ask them to offer preference judgements using rating scales (i.e. Likert scale). Examples can be found in the European countries and the US (Merkert & O'Fee, 2013; Özcan, 2014). Since humans and preference judgements are often vague, the Likert scores may be difficult to represent the respondents' preferences (Li et al., 2017). Therefore, it is important to apply a good alternative to the Likert scale (i.e. pairwise comparison method) for evaluating aviation subsidy policy in this study. On the other hand, the analytical hierarchy process (AHP) is a widely used method which may provide a theoretical underpinning and advancement to reflect the policymakers' judgement instincts to respond to complex decision-making processes in real-world applications, including air transport policy (Dožić, 2019). Since aviation subsidy policy involves public resources and values, policymakers need to be aware of stakeholders' opinions (e.g. aviation experts, industry professionals and practitioners) before implementing aviation subsidy policy design and changes that meets the multiple demands of relevant stakeholders (Arslan, 2009). In addition, when it comes to making decisions for aviation subsidy, there is growing concern about the participants' uncertainty and lack of knowledge of the subject that may lead to their judgemental statements becoming imprecise. Adopting fuzzy logic into the AHP has been suggested by many scholars to capture vague information and deal with uncertainty (Arslan, 2009; Li et al., 2017).

This study sets out to explore aviation subsidies and regional well-being outside aforementioned well-researched countries or regions by investigating the cases of New Zealand and Taiwan, where both are facing the challenges of offering better regional air connectivity between major cities and smaller regions. Tourism is important to both New Zealand and Taiwan's economy, with generating a direct contribution to gross domestic product (GDP) of USD11.8 billion (5.9 % of GDP) and USD 10.7 billion (1.8 % of GDP) in 2018, respectively (World Travel and Tourism Council, 2019). On the other hand, two cases are considered meaningful because they represent different stages of adopting aviation subsidies: New Zealand has not yet formed the national aviation subsidy policies except for a trial program named Essential Transport Connectivity (ETC) scheme introduced during the post-COVID-19 lockdown period, but Taiwan has continuously implemented aviation subsidy programs since 2006. Furthermore, the necessity of serving remote and smaller communities is a common factor for both economies. In New Zealand, the challenge of connecting remote and smaller communities is due to its geographically isolated nature. In Taiwan, air services aim to offer a timely and efficient means of connecting offshore islands and communities to mainland or key cities when compared to maritime transportation. In this study, we proposed to apply a fuzzy analytical hierarchy process (FAHP) to evaluate New Zealand and Taiwan stakeholders' perspectives of key indicators considered in adopting aviation subsidy policy. The technique of FAHP has been used in other contexts but, to the best of our knowledge, not for the air transport subsidy issues. In terms of theoretical contributions, this study surveyed different stakeholder's opinions about aviation subsidy policies via the robust Fuzzy AHP, which aims to address a knowledge gap by identifying the specific aviation subsidy policy changes or initiatives that may improve regional economic growth, tourism development, and social and environmental wellbeing. More specifically, our research serves to bridge knowledge gaps related to both air transport activities and regional well-being indicators. Notably, for economies with extensive experience in aviation subsidies, like Taiwan, it is advisable to prioritise social well-being in policy considerations. Conversely, in regions with limited experience, such as New Zealand, a greater emphasis on economic well-being is recommended. The airport served destinations and flight

frequency emerge as two pivotal factors for shaping effective aviation subsidy policies in both experienced and less experienced regions. In this study, we demonstrated the usefulness and robustness of this technique using two proof of concept applications, the cases of New Zealand and Taiwan. Identifying the differences and similarities of key indicators considered in regional aviation subsidy policies in New Zealand and Taiwan, which allow making recommendations to both governments regarding their aviation subsidy policy changes or initiatives, thus improving their regional economies, tourism, and socio-environmental wellbeing in the post-COVID-19 era.

This study therefore focuses on 25 indicators/factors of air transport activities and wellbeing categories, and identifies which ones should be considered as key factors in designing and implementing (regional) aviation subsidies. The remainder of this paper is organised as follows. Section 2 provides a review of the extant literature on the indicators of air transport activities, and the key regional wellbeing categories and indicators. Section 3 provides background on the research context in relation to regional aviation subsidies in New Zealand and Taiwan. Section 4 describes the methodology. Section 5 presents the results. Section 6 discusses the findings and policy implications. Section 7 presents the conclusion and discusses the contributions, implications as well as limitations of this study.

2. Literature review

2.1. Aviation subsidies and regional air transport activity

Gössling and Peeters (2007), and Merkert & O'Fee (2013) argued that governments have the overall responsibility of maintaining the framework of public transport systems by providing subsidies. Indeed, governments in many countries have invested substantial amounts of capital and resources (e.g. grants or cross-subsidisation, and loans and loan guarantees) or various support programmes (e.g. provision of air services on specific routes and airfare discounts for residents living in remote communities) for airlines and airports serving regional markets. More details can be found in Gössling et al. (2017) and Fageda et al. (2018). Undoubtedly, many of these subsidy policies have received criticism in terms of market distortion, policy transparency (e.g. definition of service levels, fares and time period), and subsidies' validity and efficiency (e.g. flight operations with low load factors and redundancy of subsidised community areas) (Fageda et al., 2018; Grubestic & Wei, 2012).

Regional air transportation has been recognised as being essential for facilitating the mobility of travellers (e.g. highly skilled human capital and tourists) and goods and services within peripheral regions (Bråthen & Halpern, 2012; Tveter, 2017). A number of air transport activity indicators are used by researchers to examine regional air services. The number of available seats, flight frequency and destinations served are commonly used as indicators to measure air service accessibility and the airline capacity of a region (Fageda et al., 2018; Ramos-Pérez, 2016). In addition, regional airports represent important points of access to remote locations of a country that have limited or lengthy ground access. It has been suggested that the provision of well-functioning regional airport infrastructure and efficient airport operations are vital to regional economic and social welfare gains (Baker et al., 2015; Tveter, 2017). Furthermore, Nõmmik and Antov (2017) claimed that affordable and efficient airport infrastructure and effective operations are essential for ensuring regional airports' existence and a sustainable future. Although prior research highlighted the influencing factors such as company size, government ownership, and air passenger traffic/volume on subsidy policy decisions (e.g., Forsyth, 2007; Forsyth & Guimard, 2019; Iyer & Thomas, 2021), but this study adopts a unique regional perspective to understand stakeholders opinions of important indicators of aviation subsidy policy formation and implementation from a regional and supply-side standpoint, rather than solely focusing on individual organisational factors.

2.2. Regional wellbeing

Prior studies have attempted to measure wellbeing with different levels and with different constructs or indicators, such as measurements of wellbeing at both the national and personal levels, and wellbeing with various indicators across economic, social and environmental accounts (Allin & Hand, 2014; Diener et al., 2013). This study thus applies some common indicators from the economic, social and environmental aspects to the measurement, as well as incorporating tourism indicators as the supplement because of their important contributions to New Zealand and Taiwan's regional development and economies. Transport policy provides the accessibility and availability of transport options, contributing, in turn, to the wellbeing of communities (Delbosc, 2012; Reardon & Abdallah, 2013). In rural and regional communities, air transport services can play a pivotal role in promptly transferring individuals, goods and services from one place to another, which largely contributes to the various wellbeing of those communities (Albalade & Fageda, 2016; Tveter, 2017).

2.2.1. Economic wellbeing indicators

A well-functioning air transport system enhances trade and enables people, businesses, cities and regions to be well connected, and it is essential for facilitating regional economic activities (Donehue & Baker, 2012). For instance, the growth of regional air connectivity and air passenger flows help reduce regional unemployment levels (Florida et al., 2015) and promote a greater region's per capita income (Diener et al., 2013), thus bringing economic and social benefits to the region. It should be noted that two key indicators (regional unemployment and a region's per capita income) are always considered to be important for analysing regional economic wellbeing (Layard, 2010). Moreover, regional air services provide substantial benefits for the regional import and export trade, as air services are vital for reducing some barriers to the movement of goods and services (Merkert & O'Fee, 2013). Furthermore, there is a strong possibility that regional aviation subsidies may support business communities, including attracting new local businesses and inward investments (Bråthen & Halpern, 2012), not to mention the significant impacts of investments to improve regional air transport by foreign direct investors (Bannò & Redondi, 2014).

2.2.2. Social wellbeing indicators

Improved air connectivity to and from regions can play an important role in many aspects of people's lives. Since air travel demand for regional routes tends to be low, airlines may provide less frequent and more expensive flight services, or may not offer any flight services at all (Bitzan & Chi, 2006). Therefore, airfares on regional routes are frequently used as the main indicator in the air transport literature to measure regional social wellbeing (Bråthen & Halpern, 2012; Fageda et al., 2016; 2017). It is widely known that regional air services help residents living in remote or isolated communities to overcome the geographical difficulties of being isolated or having limited surface transport, thus delivering lifeline services to ensure necessary access to medical treatment, visiting friends and relatives, education and social cohesion, etc. (Bråthen & Halpern, 2012; Merkert & O'Fee, 2013). Particularly for elderly people, increased air mobility may lead to more frequent air travel for enjoying leisure activities, pursuing interests, meeting with relatives and friends, or even accessing medical services (Bråthen & Halpern, 2012; Svenson et al., 2006). Furthermore, many prior studies have found that mobility also plays an essential role in affecting residents' social wellbeing in terms of their enjoyment of leisure time (Spinney et al., 2009; Stanley et al., 2010). Another indicator of social wellbeing that might be relevant to regional air transport is housing affordability. Since an airport has long been considered to be a crucial driver of economic activity in a region (Appold, 2015), a few prior studies have empirically investigated the relationship between air transport activity and housing prices in both major and smaller regions (Biagi et al., 2015; Tsui et al., 2017). Finally, some research has

highlighted the importance and use of regional airports during and after catastrophes, such as for rapid hazard response (e.g. search and rescue services) (Minato & Morimoto, 2012; Smith, 2010). This enhances a regional airport's responsiveness to catastrophes or natural disasters and provides a new rationale for establishing and maintaining regional air transport, a topic that has otherwise been discussed primarily from the connectivity and economic perspectives.

2.2.3. Environmental wellbeing indicators

Environmental concerns are rising rapidly around the world. The aviation sector, like all other industries, is also facing increasing environmental pressure from the public. Graham (2013) suggested using five primary indicators to measure the environmental impacts at the regional level, namely air quality (emissions), noise, wildlife, heritage and landscape, waste management, and water use and pollution. Increasing air traffic volumes to and from the region are generally accompanied by additional air travel emissions (Ryerson, 2016). In addition to emissions from aircraft, airports have large numbers of ground support vehicles that contribute to the worsening of local air quality (Daley et al., 2008; Hooper & Greenall, 2005). Another important environmental impact indicator of aviation is aircraft noise, which has been used as an environmental wellbeing indicator in prior studies (Chang et al., 2015; Mak et al., 2007). Moreover, airports require large land areas that are hostile to wildlife because of a loss or disruption of wildlife habitats, vegetation damage or removal, and the development of airport surroundings. Finally, water use and pollution, as well as waste management, are also problematic because of airlines and airport operations (Tofalli et al., 2018).

2.2.4. Tourism indicators

Regional tourism and air transport are explicitly linked (Spasojevic et al., 2018). In the tourism and air transport literature, researchers have generally achieved a consensus that air transport and tourism are mutually dependent, with airlines often involved in the planning and development of tourist destinations, whereas tourism destinations may benefit from local airports' activities or the development of new airline routes, ultimately facilitating inbound tourism growth (Castillo-Manzano et al., 2011; Forsyth, 2016; Tsui, 2017). Moreover, better and more convenient air services provide benefits to local residents in terms of providing them with opportunities to travel outside the regions (Baker et al., 2015; Forsyth, 2016). Accommodation occupancy has also been considered as an important indicator, as it may reflect a region's tourism demand and patterns (De Cantis et al., 2011). Furthermore, an increase in visitor expenditure in the region, for example, retail, car rentals, food and beverages, have positive effects on the region's economy (Forsyth, 2016). Consequently, while tourism can be treated as an independent industry, it is reasonable to examine those tourism-related indicators as wellbeing factors that can stimulate other economic and socio-environmental wellbeing of the regions.

3. Regional aviation subsidies in New Zealand and Taiwan

3.1. New Zealand

Road and rail transportation in New Zealand seem to be time-consuming to get to small communities in isolated and remote areas. The state highway networks are the principal road infrastructure connecting New Zealand's major urban centres. The national rail services are largely focused primarily on freight transportation, with limited tourism focussed services on some routes. According to Environmental Health Intelligence New Zealand (2018), 16.3 % of New Zealanders lived in rural areas. Consequently, air transport plays an important role in maintaining regional connectivity, which links geographically dispersed parts of New Zealand.

There are 29 certificated aerodromes operating in New Zealand (Civil Aviation Authority of New Zealand, 2020), but only 26

commercial airports offer scheduled flight services (see Appendix 1). Auckland, Christchurch and Wellington airports serve as key domestic aviation hubs that connect to each other and to smaller regional airports, whereas small regional airports function as nodes that connect to the three domestic hub airports. New Zealand’s airport system, in which only one commercial airport per city or region (Fu et al., 2020). However, New Zealand’s airport industry is facing a range of financial pressures, such as the combination of the high costs of maintaining airport infrastructure and complex operations (e.g. operational and safety regulatory requirements), the commercial sustainability of air services and financial sustainability (New Zealand Airports Association, 2017). Over time, these financial pressures may influence small regional airports’ future viability and ability to serve their communities.

Furthermore, smaller airlines (e.g. Jetstar and Sounds Air) may also be forced to cease operations due to a lack of patronage, high operating costs per seat, small market demand or a combination of all these factors. Aviation in New Zealand has no national funding system. Often, the local governments stepped in to underwrite air services and fund airport infrastructure to ensure essential air connectivity to their regions (e.g. Sounds Air operating a Westport–Wellington service and Air Chatham operating a Whakatane–Auckland service) (New Zealand Airports Association, 2017). Regional air transportation also received financial support from various government projects. The New Zealand government has allocated three billion dollars (NZD) from the Provincial Growth Fund to invest in regional economic development including regional connectivity and wellbeing. For example, Invercargill Airport received NZD\$500,000 from the Provincial Growth Fund in 2019 for upgrading terminal facilities to accommodate the newly launched Auckland to Invercargill service. In 2020, given the immense impacts of the COVID-19 pandemic that has had upon the New Zealand’s regional aviation industry, the trial aviation subsidy program (i.e. ETC scheme) was introduced by the Ministry of Transport to provide support for air transport providers (e.g. airports, airlines, and aviation support services) over the short term in the post-COVID-19 lockdown period. The objective of this scheme is to ensure capacity, regional connectivity, and essential services are maintained in the wake of COVID-19 (Ministry of Transport, 2020). For example, Sounds Air (a small regional airline based at Picton) received NZD\$30 million to keep flying to remote communities (e.g. Blenheim and Westport airports). The combination of the importance of a fit-for-purpose air transport network to regional economic growth and enhanced social connection and the devastating impact of COVID-19 highlights the urgency of understanding stakeholders’ and policymakers’ perspectives concerning the link between aviation subsidies and regional wellbeing outcomes.

3.2. Taiwan

Taiwan’s most important urban transportation system is concentrated in three metropolitan areas on the west coast: Taipei, Taichung and Kaohsiung, where the majority of economic, population and tourism activities are located. Intercity transportation between major cities relies mainly on highways and the Taiwan High Speed Rail (THSR). Unlike the west coast’s well-developed highway networks and THSR, many cities or

Table 1
Offshore islands’ air transport services subsidies (2012–2017).

Years	Airfare discounts for offshore island residents (million NT\$)	Annual premiums (million NT\$)	Subsidies for air routes of offshore islands (million NT\$)
2012	386.3	12.5	145.0
2013	609.4	12.5	183.7
2014	731.3	15.0	190.3
2015	844.0	15.0	190.3
2016	928.3	15.0	444.4
2017	968.1	15.0	455.3

Source: Civil Aviation Authority (2019).

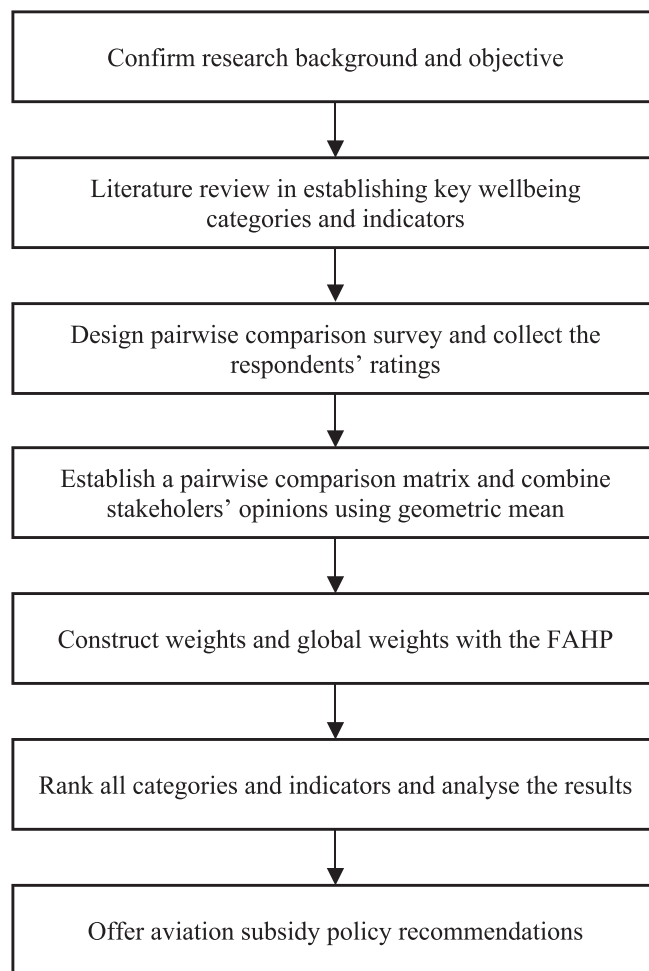


Fig. 1. Research framework.

counties on the east coast (e.g. Hualien and Taitung) and communities on offshore islands (e.g. Kinmen, Matsu and Penghu) still have limited surface transport. According to the Ministry of the Interior (2020), 21.5 % of the population of Taiwan is rural population. Air transportation still plays a vital role in providing connections linking cities or counties, offshore islands and metropolises, thus delivering considerable economic and social benefits to offshore island residents (Dai et al., 2004).

Currently, 17 civil airports in Taiwan are operated by the Taiwan Civil Aeronautics Administration and 15 of them provide scheduled domestic air services (Taiwan Civil Aeronautics Administration, 2020) (see Appendix 2). To improve connections among offshore islands and remote communities, the Taiwanese government provides financial support to airlines operating scheduled services through three primary forms of subsidy: (1) airfare discounts for offshore island residents, (2) annual premiums for airlines accomplishing required air services, and (3) a subsidy scheme for airlines to cover their losses when operating air routes to remote offshore islands. Table 1 shows a considerable increase in Taiwanese government’s expenditures on airfare discounts for offshore island residents and subsidies for air routes of remote offshore islands. Between 2012 and 2017, the Taiwanese government’s spending for airfare discounts for offshore island residents increased by 251 %, and subsidy scheme expenditures have tripled. As of March 2020, the Ministry of Transportation and Communication (MOTC) announced a package of financial aid for the Taiwan’s aviation industry, in the form of subsidies and loans, to cope with the impact of the COVID-19 pandemic. The relief package covers airlines, airports, airport terminal retailers, and catering services (Ministry of Transportation and Communications, 2020a). Aviation subsidies in the relief package also

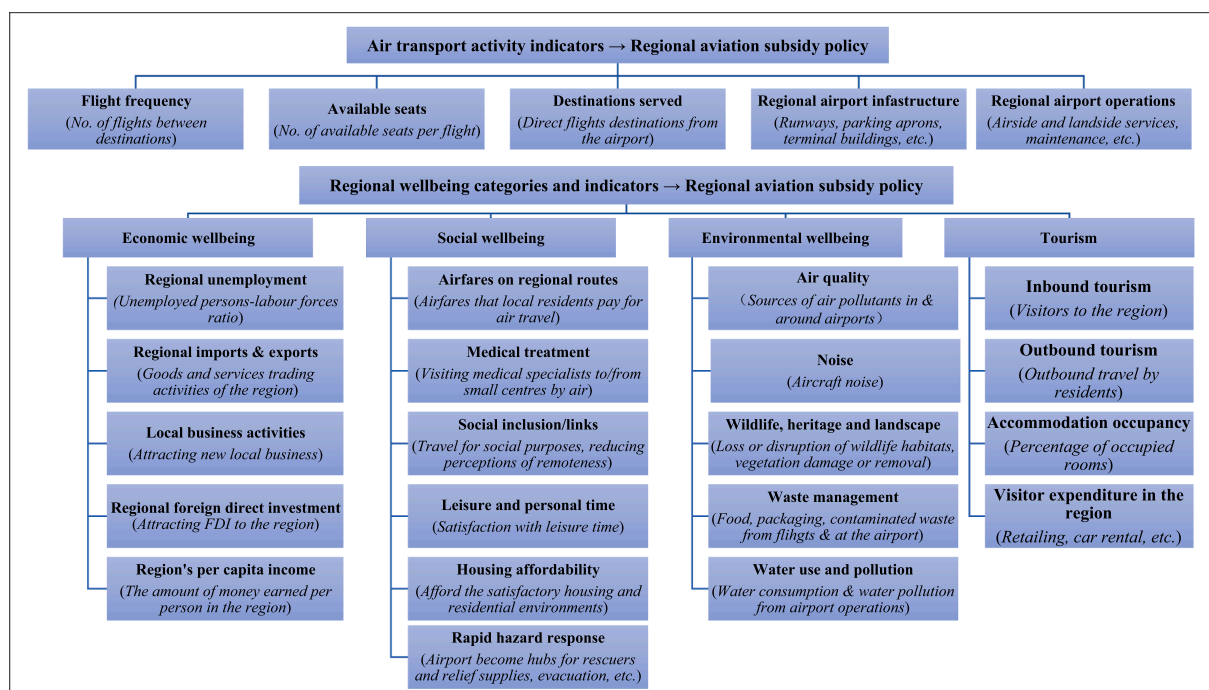


Fig. 2. Hierarchy of the FAHP model for forming or designing regional aviation subsidy policy.

include funding each flight costs, landing fees, land and warehouse use fees, and maintenance hangar use fees, etc. Importantly, the Taiwanese Government also offered loans to help regional airlines keep operating offshore island routes during the Covid-19 period. In April 2020, the MOTC unveiled a second round of relief measures to the aviation industry, with NT\$50 billion credit guarantees from the Taiwanese Government (Ministry of Transportation and Communications, 2020b). The primary challenge for Taiwan's aviation sector is a considerable increase in government expenditure on airfare discounts for offshore island residents and subsidies for air routes to remote offshore islands in recent years. Funding from the Taiwanese government still appears insufficient to encourage regional airlines to continue providing adequate flight services to remote offshore islands, consequently affecting offshore island residents' wellbeing (Ministry of Transportation and Communications, 2020c). As such, there is a need to gather the perspectives of stakeholders and policymakers to deepen the knowledge of the interplay between aviation subsidies and regional wellbeing outcomes, which could be a useful supplement to aviation subsidy regulation changes aimed at improving the offshore islands' air services.

4. Methodology

This study presents a method for aggregating preferences, opinions, and views of various stakeholders that allows all their viewpoints to be represented, but also yields a clear hierarchy structure among them so that a united front could be presented in stakeholder requests. It focuses on 25 indicators/factors of air transport activities and wellbeing categories, and identifies which ones are considered as key factors in designing and implementing (regional) aviation subsidies. The AHP is a multi-criteria decision-making process that estimates the relative magnitude of criteria or factors through pairwise comparisons (Saaty, 2008). The major advantage of the AHP is that it does not require a large sample size to achieve sound and statistically robust results, and this approach can focus on a specific issue (Doloi, 2008; Saaty, 2008). Although AHP is an effective tool for multi-criteria decision-making, the application of AHP may suffer a few drawbacks, such as the uncertainty and subjectivity of the factor comparisons, as participants may not precisely express their preferences (e.g. Li et al., 2017; Mahtani & Garg,

2018; Pehlivan et al., 2017); however, these shortcomings can be reduced by applying a fuzzy approach to the conventional AHP (FAHP). Our study follows the same procedure as these previous studies that applied FAHP. For the sake of brevity, more details about the FAHP applied in this study can be seen in Appendix 3. Fig. 1 presents the research framework of this study.

Fig. 2 demonstrates the hierarchy structure of the FAHP model for this study, and an online questionnaire (see Appendix 4) was structured. Following the approach of Saaty (2008), the questions were asked to rate on a nine-point scale for the comparison of the wellbeing categories and indicators. Target stakeholders residing in New Zealand and Taiwan were contacted and surveyed: (1) industry practitioners, including regional airport and airline managers; (2) aviation researchers, including academic scholars from universities and research institutions; (3) government agencies, including officials from the Civil Aviation Authority of New Zealand and Taiwan's Civil Aeronautics Administration, the Ministry of Transport and other transport-related agencies; (4) regional and local governments, including councillors who are responsible for regional transportation policies; and (5) others, including experts and staff from tourism and environmental groups. All the potential participants who must understand and work in the aviation or related sectors, reflecting their diverse backgrounds, expertise and knowledge of aviation subsidy.¹ Particularly, aviation researchers' responses were sought in reinforcing the aviation experts, industry professional and practitioners' point of view. Incorporating diverse stakeholders may introduce potential response bias. However, the fuzzy Analytic Hierarchy Process (FAHP) relies on expert experience and knowledge to evaluate objective features, and uniquely, it can identify and rectify bias and inconsistencies in subjective judgments, leading to a more consistent final ranking (Hsu et al., 2009; Lee & Yang, 2018; Lin, 2021). The surveys were carried out in New Zealand and Taiwan simultaneously after the occurrence of COVID-19 crisis from March to June 2020. In

¹ Air passengers were intentionally excluded as survey respondents. This decision was motivated by the survey's comprehensive scope, which extended beyond air transport to encompass regional well-being, including economic, social, and environmental aspects.

Table 2
Rankings of air transport activity indicators using FAHP and AHP.

Indicators	New Zealand		Taiwan	
	Rank (FAHP)	Rank (AHP)	Rank (FAHP)	Rank (AHP)
Flight frequency	2	2	2	2
Available seats	3	3	3	3
Destinations served	1	1	1	1
Regional airport infrastructure	4	4	4	4
Regional airport operations	5	5	5	5

total, 51 (New Zealand) and 45 (Taiwan) responses were received. Participants were mainly recruited via email and social media, and aviation or transport-relevant associations or organisations (e.g. Transport Knowledge Hub of the Ministry of Transport of New Zealand) were contacted to mail out the survey invitations to their members. It is unknown the total number of aviation experts and stakeholders who received the questionnaire, and therefore the response rate is not available in this case. After eliminating incomplete responses with unanswered questions in the questionnaire, 36 (New Zealand) and 43 (Taiwan) responses are used for further analyses. In multiple-criteria decision making (MCDM) studies such as AHP, there's no empirical or theoretical evidence on how the expert panel size affects evaluation results (Lin, 2021). However, the panel size selection remains subjective, with recommendations varying from five to seven experts (Robbins & Coulter, 2012) to 10 to 15 experts (Hwang & Lin, 2012), typically not below 10 (Lee & Yang, 2018).

In the AHP analysis, pairwise comparisons may lead to some inconsistencies because individual judgments could be affected by a lack of rationality and violate the consistency condition of the matrix (Saaty, 2008). Hence, it is necessary to obtain the consistency ratio (CR) of our survey for checking the reliability of participants' responses. Generally, a CR value of a response is lower than 0.1 should be acceptable (Lee & Walsh, 2011; Saaty, 2008). For the sake of brevity, more details on this consistency check or method can be seen in previous AHP studies such as Brunelli (2014) and Saaty (1987). According to the results of the pairwise CR analysis, 25 New Zealand participants and 22 Taiwanese participants provided reliable answers with a CR of 0.1 or smaller for all comparison matrices. Detailed demographical information of the New Zealand and Taiwanese participants is shown in the Appendix 5.

In the FAHP, triangular fuzzy numbers are computed to represent the relative importance in the comparison matrices (Pehlivan et al., 2017; Zhu et al., 1999). In this study, the geometric mean of each participant's responses was computed for aggregating group responses (Davies, 1994; Kar, 2014). Next, the geometric mean method of FAHP² developed by Buckley (1985) was used to maintain consistency with the aggregation of group responses. According to Pehlivan et al. (2017), a major advantage of the geometric mean method is that it is easy to extend to the fuzzy case without complex computations. This method has been

² For the sake of brevity, more details regarding the geometric mean method of FAHP can be found in the previous AHP literature (Chen & Chen, 2010; Pehlivan et al., 2017). Another popular FAHP method (the extent analysis method) was also performed as a robustness check (Chang, 1996). However, it suffers from the shortcoming that it may assign zero weights during computation. Therefore, the weights obtained from the geometric mean method were reported. Furthermore, to enhance the robustness of our analysis, we applied the AHP methodology without integrating the fuzzy theory, specifically the aggregating individual priority (AIP) approach. Notably, the results obtained from the AHP using the AIP method (see Appendices 7a and 7b) are similar to those obtained by applying the geometric mean method in Fuzzy AHP (FAHP) method (see Appendices 6a and 6b). Consequently, the weights in this study, derived from the geometric mean method in FAHP, are reported with confidence.

used in this study to obtain the fuzzy weights of air transport activity indicators, and regional wellbeing categories and indicators, followed by adopting two ranking systems, namely ranking (within the air transport activity and a specific regional wellbeing category) and overall ranking (within the four regional wellbeing categories).

5. Results

Results of the FAHP technique are shown in Tables 2 and 3. In addition to applying the AHP technique under fuzzy conditions, the standardized AHP was also conducted and presented for comparison purposes. As a group of target stakeholders were contacted and surveyed, the weights of regional wellbeing categories and indicators are determined by combining the questionnaire results, taking the geometric average of pairwise assessments by the target stakeholders. The results of the AHP method (see Appendices 7a and 7b) are similar to those of the FAHP technique (see Appendices 6a and 6b), except for a minor difference in the ranking of regional wellbeing categories and indicators was noted. Therefore, the results of FAHP method were reported with confidence.

5.1. Air transport activities

The ranking of the air transport activity indicators for New Zealand and Taiwan are shown in Table 2. For both New Zealand and Taiwan, *destinations served* had the highest fuzzy weight; consequently, it is the most important indicator to be considered by participants when designing and implementing aviation subsidies. The next important indicators are *flight frequency*, *available seats* and *regional airport infrastructure*. The least important indicator is *regional airport operations*.

5.2. Regional wellbeing categories and indicators

5.2.1. Ranking of regional wellbeing categories

The ranking of the regional wellbeing categories for New Zealand and Taiwan is shown in Table 3. For New Zealand, *economic wellbeing* has the highest rank as the primary wellbeing outcome to be considered by participants when designing regional aviation subsidies. The next highest ranked regional wellbeing categories are *social wellbeing*, *environmental wellbeing* and, lastly, *tourism*. Regarding Taiwan, *social wellbeing* as a result of implementing aviation subsidies stands out as the top-ranked category, followed by *economic wellbeing*, *tourism*, and lastly *environmental wellbeing*.

5.2.2. Ranking and overall ranking of each indicator

Table 3 also shows the overall rankings of all regional wellbeing indicators. New Zealand's top four regional wellbeing indicators are *local business activities*, *wildlife, heritage and landscape*, *medical treatment* and *visitor expenditure in the region*. In Taiwan's context, the top four regional wellbeing indicators are *visitor expenditure in the region*, *medical treatment*, *rapid hazard response*, and *inbound tourism*.

Amongst New Zealand's stakeholders, *local business activities* takes the top rank in the *economic wellbeing* category, followed by *regional imports and exports*, *regional unemployment* and *region's per capita income*. It is noted that the results obtained from the AHP method show that *regional unemployment* is slightly more important than *regional imports and exports*.³ The least important indicator is *regional foreign direct investment*, suggesting that it is the least important outcome to be considered when implementing aviation subsidies. With respect to the

³ As shown in Appendices 6b and 7b, it is observed that *regional unemployment* and *regional imports and exports* for the New Zealand case share the similar weights. The fuzzy theory as FAHP has ability to process such information because it allows uncertainty and fuzziness in decision-making as suggested by many scholars (e.g. Arslan, 2009; Li et al., 2017; Mahtani & Garg, 2018).

Table 3
Rankings of regional wellbeing categories and indicators using FAHP and AHP.

Regional wellbeing categories	New Zealand		Taiwan		Regional wellbeing indicators	New Zealand				Taiwan			
	Rank (FAHP)	Rank (AHP)	Rank (FAHP)	Rank (AHP)		Overall rank (FAHP)	Overall rank (AHP)	Rank (FAHP)	Rank (AHP)	Overall rank (FAHP)	Overall rank (AHP)	Rank (FAHP)	Rank (AHP)
Economic wellbeing	1	1	2	2	<i>Regional unemployment</i>	8	7	3	2	7	5	2	1
					<i>Regional imports & exports</i>	7	8	2	3	17	17	5	5
					<i>Local business activities</i>	1	1	1	1	6	7	1	2
					<i>Regional foreign direct investment</i>	16	16	5	5	13	13	4	4
					<i>Region's per capita income</i>	9	9	4	4	10	10	3	3
Social wellbeing	2	2	1	1	<i>Airfares</i>	17	17	5	5	9	9	3	3
					<i>Medical treatment</i>	3	3	1	1	2	2	1	1
					<i>Social inclusion and links</i>	14	14	4	4	11	11	4	4
					<i>Leisure and personal time</i>	19	20	6	6	19	19	6	6
					<i>Housing affordability</i>	13	13	3	3	18	18	5	5
Environmental wellbeing	3	3	4	4	<i>Rapid hazard response</i>	5	5	2	2	3	3	2	2
					<i>Air quality</i>	15	15	5	5	14	14	3	3
					<i>Noise</i>	11	11	3	3	8	8	1	1
					<i>Wildlife, heritage and landscape</i>	2	2	1	1	15	15	4	4
					<i>Waste management</i>	12	12	4	4	16	16	5	5
Tourism	4	4	3	3	<i>Water use and pollution</i>	6	6	2	2	12	12	2	2
					<i>Inbound tourism</i>	10	10	2	2	4	4	2	2
					<i>Outbound tourism</i>	18	18	3	3	20	20	4	4
					<i>Accommodation occupancy</i>	20	19	4	4	5	6	3	3
					<i>Visitor expenditure in the region</i>	4	4	1	1	1	1	1	1

Note: The rank is based on the participants' responses within a specific regional wellbeing category. The overall rank is based on the participants' responses within all four regional wellbeing categories (20 regional wellbeing indicators in total).

social wellbeing category, *medical treatment* has the highest importance, followed by *rapid hazard response* and *housing affordability*. Other indicators with lower importance are *social inclusion and links*, *airfares*, and *leisure and personal time*. For the *environmental wellbeing* category, *wildlife, heritage and landscape* received the highest rank, followed by *water use and pollution, noise, waste management, and air quality*. In addition, 'visitor expenditure in the region' has the highest importance in the *tourism* category, followed by *inbound tourism, outbound tourism, and accommodation occupancy*.

For Taiwan's stakeholders, *local business activities* and *regional unemployment* are the most important indicators in the *economic wellbeing* category, in terms of the decision-making process of aviation subsidies which presented in both FAHP and AHP methods, although the AHP results have different rankings compared to the FAHP results in which *regional unemployment* occupies the top rank.⁴ For the *social wellbeing* category, *medical treatment* is the most important indicator, followed by *rapid hazard response, airfares, and social inclusion and links*. Other indicators that are lower in importance are *housing affordability* and *leisure and personal time*. With regard to the *environmental wellbeing* category, *noise* occupied the top rank and is the issue of greatest concern for the participants, followed by *water use and pollution, air quality, wildlife, heritage and landscape, and waste management*. *Visitor expenditure in the region* is considered as the most important indicator under the *tourism* category, followed by *inbound tourism* and *accommodation occupancy*.

Outbound tourism was the least important indicator.

6. Discussions and implications of key findings

Several key findings are worth highlighting and discussing. These findings provide policy implications for stakeholders and policymakers in New Zealand and Taiwan while forming and implementing regional aviation subsidies.

6.1. The importance of destinations served

It is necessary to consider the effect of aviation subsidies on existing regional air connections. Both New Zealand and Taiwanese participants achieved a consensus about the ranking of *destinations served* as the most important factor of air transport activity when forming or implementing regional aviation subsidies. This finding supports prior research, which indicated the positive impact of aviation subsidies on domestic connectivity levels, preventing lapses in small communities' air services (Merkert & O'Fee, 2013).

For New Zealand, it is important to recall that Air New Zealand and Jetstar, the two leading domestic carriers, pulled out flight services connecting three major domestic hub airports (i.e. Auckland, Christchurch and Wellington) to several regional destinations in the past few years. Hence, this study suggests that aviation subsidies could be used to help New Zealand's regional and small airports host more destinations and resume connections from hub airports. On the other hand, aviation subsidies can be used as a mechanism to support and improve the

⁴ Same explanation as Footnote 4.

essential air services between smaller underserved regions provided by small regional carriers (e.g. Sounds Air). Indeed, the newly introduced ETC scheme exactly has supported small regional carriers to retain their services to small and remote regions. In the case of Taiwan, the finding indicates that *destinations served* should always be viewed as a key factor for future subsidy policy changes. It is worth noting that this finding supports the currently implemented aviation subsidy schemes (i.e. subsidy schemes for air routes to remote offshore islands and annual airline premiums), which have specifically included requirements related to *destinations served* (i.e. service to a certain number of offshore islands) as one of the primary conditions for aviation subsidy applications from airlines.

6.2. Flight frequency is another key factor of aviation subsidy

In addition to *destinations served*, *flight frequency* is another important aspect to be considered when forming and implementing aviation subsidies by New Zealand and Taiwanese participants. This also accords with prior studies, which showed that regional aviation subsidies produce welfare gains, reflected by increasing flight frequencies to the regions (Di Francesco & Pagliari, 2012; Ramos-Pérez, 2016).

In New Zealand, the majority of regional routes are operated by Air New Zealand, and a few routes are offered by small airlines, both with less than five daily flights. Hence, if the New Zealand government wants to support the regional aviation sector, aviation subsidies to regional carriers by increasing the *flight frequency* between major cities and smaller regions should be one of the main strategic options considered. This is in line with most subsidy programmes in the US and European countries (e.g. Essential Air Service (EAS) and Public Service Obligation (PSO)), which specify the flight frequency requirements in the subsidy contracts (Fageda et al., 2018; Özcan, 2014). In Taiwan's case, the existing aviation subsidy programmes (i.e. a subsidy scheme for air routes to remote offshore islands and annual airline premiums) have explicitly required a minimum number of daily flights to fly to each offshore island. As Taiwanese participants believed *flight frequency* to be the key factor, the existing subsidy programmes regarding the requirements of *flight frequency* need to be carefully monitored and regularly tracked by policymakers.

Practically, airlines have two main options to accommodate growing demand for a route: increase flight frequency or use larger aircraft with more seat capacity (Wang et al., 2014). However, in New Zealand and Taiwan, while improving air transport-related activities to smaller regions or remote areas is the main objective of aviation subsidies, thus preference should be given to an increase in *flight frequency* instead of increasing *seat capacity* because most regional airports in New Zealand and Taiwan are relatively small and can only accommodate smaller aircraft (e.g. ATR72, Cessna 208 Caravan, Pilatus PC-12, Embraer ERJ-190, Bombardier Q400).

6.3. Integrating economic and social wellbeing into aviation subsidy policy design

In this study, New Zealand participants indicated that *economic* and *social wellbeing* are equally important considerations in regional aviation subsidy policy formation, whereas Taiwanese participants significantly prioritised *social wellbeing* outcomes over *economic wellbeing*. Notably, such findings offer fresh insights into the interplay of regional aviation subsidies, air transport activity and regional wellbeing from the perspectives of various stakeholders, as there is still a lack of evidence on aviation subsidies' effects on regional economic and social wellbeing through improved regional air transport links. The different results among New Zealand and Taiwan might be attributed to their different approaches/policies towards aviation subsidy as mentioned in Sections 1 and 3. It is worth noting that roads or highways can connect most remote communities in New Zealand despite being time-consuming, and rural communities with comparatively poor access to air transport

already struggled with social and economic sustainability (Fu et al., 2020). Thus, subsidised regional air services seem to be equally critical to facilitate regional economic growth and offer significant social benefits to smaller communities in New Zealand. Whilst aviation subsidies in Taiwan primarily aim to provide better air connections between offshore islands and the main island of Taiwan, island residents' social welfare attracted great attention as the Taiwanese government subsidised airlines to operate a minimum number of daily flights and offered airfare discounts to island residents to fly. Additionally, highlighting the contrasting aviation subsidy approaches of New Zealand and Taiwan is essential. New Zealand, lacking a specific aviation subsidy policy prior to the COVID-19 pandemic, placing a strong emphasis on the value of subsidised regional air services in fostering regional economic growth and community welfare. In contrast, Taiwan's aviation subsidies primarily target in improving air connectivity between the mainland and offshore islands, with a distinct focus on enhancing the quality of life and air connectivity for offshore islands' communities, prioritising social wellbeing over economic considerations. These findings have broader implications and can inform other countries without regional aviation subsidy policies, those that have already implemented one, or guide the future direction of regional wellbeing considerations in aviation subsidy policy formation and implementation.

Among the economic wellbeing indicators included in this study, *local business activities* was found to be a key factor by New Zealand and Taiwanese participants. Consistent with the literature, regions that are connected and equipped with a modern and resilient transport infrastructure could help small businesses to grow their businesses domestically and internationally, which, in turn, helps to shape a strong and vibrant economy in the region (Ramos-Pérez, 2016). In New Zealand, 97% of all enterprises are small businesses with less than 20 employees, playing a vital role in sustaining regional and rural communities (Ministry of Business, Innovation & Employment, 2020). In Taiwan, this finding further supports the idea of continually developing local businesses (e.g. Kinmen Kaoliang Liquor) through improved offshore air transportation and tourism activity (National Development Council, 2016). In addition, *regional unemployment* is another economic wellbeing indicator that has received attention from Taiwanese participants. It is believed that improved offshore air services can facilitate local businesses and tourism development, thus creating more job vacancies for offshore island residents (National Development Council, 2016).

Of all the social wellbeing indicators, *medical treatment* and *rapid hazard response* are the greatest concerns of both New Zealand and Taiwanese participants. Although air ambulance flights are mostly performed by helicopters in New Zealand, two-engine turbine aircraft (e.g. King Air 200) are also used when they are able to operate from aerodromes (Ministry of Health, 2020). In continuously improving local residents' *medical treatment*, the New Zealand government needs to devote their efforts and maintain regional air services. This pinpoints the critical role of regional flight services and well-functioning small regional airports, as a reduction in regional flight services or the closure of smaller aerodromes may affect urgent medical transfer flight services in New Zealand. Similarly, a timely and cost-effectively air services seem to be essential for offshore island residents in Taiwan to access health services in the metropolises. The Taiwanese government showed a strong interest in advancing the offshore islands' air transportation to improve the performance of health services, for instance, stationing aircraft at three offshore islands (i.e. Kinmen, Matsu islands and Penghu) for the use of emergency medical transfers (National Development Council, 2016).

Moreover, New Zealand and Taiwan are susceptible to natural disasters (e.g. earthquakes and typhoons). Previous studies have shown the important role of regional airports in the case of a catastrophe (Minato & Morimoto, 2012; Smith, 2010). Aerodromes are regarded as national lifeline utilities by the Civil Aviation Authority of New Zealand in their advisory circular (AC139-14), as airstrips and aerodromes are an essential part of disaster response, particularly when roads or land

transport are cut off (New Zealand Airports Association, 2017). The recent case of the 2016 Kaikōura earthquake in New Zealand clearly supports the view that disaster response and recovery and air services are closely linked. In a similar vein, it is also important for the Taiwanese government to integrate offshore islands' air services with an improved emergency management system to reduce the negative consequences of disasters and for search and rescue purposes.

There is a nexus between aviation subsidy policies and regional wellbeing (e.g. economic and social wellbeing). From the discussions above, continued efforts to effectively and strategically form and implement aviation subsidy are needed by both the New Zealand and Taiwanese governments. Despite the differences in aviation subsidy policies' maturity, economic and physical geography between New Zealand and Taiwan, New Zealand's policymakers could learn from Taiwan's experience by forming a national aviation funding system that will not only incorporate the objective of regional development but also directly benefit residents living in smaller and remote communities and improving their social wellbeing. As for Taiwan's policymakers, the regional aviation subsidy policy needs to be continuously monitored and amended to better cope with the social benefits increase and potential demand growth in offshore island residents' medical treatments. Nevertheless, it is imperative to recognise that the policy implications derived from the respondents' opinions in this study might have been slightly influenced by the ongoing COVID-19 pandemic, which shifted their focus and concerns towards social health and medical welfare. Despite this, aspects such as airfares, housing affordability, social inclusion, and connectivity also drew the respondents' attention, even though they held slightly lower weights compared to medical treatment and rapid hazard responses. Therefore, our study suggests that policymakers in both New Zealand and Taiwan should consider placing increased emphasis on incorporating social welfare considerations into their aviation subsidy policy formation and implementation during the post-COVID-19 era.

6.4. Calling attention to environmental externalities associated with aviation subsidies

The environmental concern was a relatively low priority for New Zealand and Taiwanese participants when considering the issue of regional aviation subsidies, but *water use and pollution* was voiced for both cases. A possible explanation for this might be that increasing regional air traffic volumes may increase environmental concerns regarding water usage and disposal.

In addition, the indicator of *wildlife, heritage and landscape* is likely to be of great importance for future aviation subsidy policy formation by New Zealand participants. It is believed that building additional facilities and infrastructure at regional airports may potentially be hostile to wildlife (e.g. disrupting, displacing or damaging their habitat) and that airports' surroundings will be developed into a more urbanised setting (Higham et al., 2019). There is little information in any previous New Zealand government's policy document about mitigating the effects of air transport development on *wildlife, heritage and landscape*, thus this finding suggests that greater attention should be given to this environmental factor in New Zealand's future aviation subsidy policy design.

In the context of Taiwan, the participants predominantly focused their attention on the indicator of *noise*. It is known that the Taiwanese government has introduced multiple regulations for noise monitoring and control schemes at airports, and has provided subsidies to residents who have been living in specified areas around airports since 2000 (e.g. the Airport Compensation Fund Allocation and Use Regulations) (Environmental Protection Administration, 2020). Therefore, this finding corroborates the importance of implementing noise control at airports in offshore islands by the Taiwanese government. However, with a small sample size, caution must be applied when discussing these results and making further policy recommendations.

The differences in New Zealand and Taiwan's findings are shaped by

their diverse stages of aviation subsidy implementation. New Zealand, marked by its isolated smaller communities with limited air transport access, prioritises the conservation of biodiversity, heritage, and landscapes. In contrast, Taiwan's focus on subsidising frequent air services for connecting offshore islands and communities, but a distinct concern centered on aircraft and airport noise due to more aviation activities being available in these areas. These contrasting findings shed light on the evolving landscape of environmental considerations in regional aviation subsidy policy formation and implementation. Importantly, the cases of New Zealand and Taiwan have the potential to guide the direction of their future aviation subsidy policies, and serve a valuable reference for other countries grappling with the balance between regional development and environmental protection within their own aviation subsidy frameworks. It is also noteworthy that New Zealand and Taiwan are now at the forefront of concerns regarding the growing pressures of tourism management (Ministry of Business, Innovation & Employment, 2019; Ministry of Transportation and Communications, 2017). This means that the concerns about wildlife interactions, noise, water usage and pollution associated with aviation activities (e.g. flight services and airport operations) might be swamped by increased pressure on the entire region's environmental impacts.

6.5. More attentions needed for aviation subsidies benefiting regional tourism

It seems that spurring the regional tourism sector is not the main factor to be considered by either government for forming or implementing aviation subsidies. Even in prior studies, little is known about the interaction between aviation subsidies and regional tourism, although tourism's close relationship with regional air transportation and local economy has been identified (Castillo-Manzano et al., 2011; Spasojevic et al., 2018). As the poorly connected peripheral regions may have valuable natural resources and display life and nature that are not affected by modern society (e.g. New Zealand's indigenous tourism and Taiwan's forest recreation tourism), these could be attractive features for tourists seeking a periphery experience (Lee et al., 2010; Riddle & Thompson-Fawcett, 2019). Therefore, tourism in remote regions and rural areas may require substantial air transport development, which will transport more tourists and bring various benefits to the remote regions (Carson & Harwood, 2007). This study shows that two important tourism factors, *visitor expenditure in the region* and *inbound tourism*, need to be emphasised by New Zealand and Taiwanese participants.

The New Zealand government has worked closely with local councils, businesses and communities to promote regional accessibility (e.g. improved regional transportation, including air services) and high-quality and authentic visitor experiences (e.g. building more quality tourism infrastructure, and incorporating the unique Māori culture into the destination brand), which ensure that regional tourism destinations are more attractive (Ministry of Business, Innovation & Employment, 2019). The growth of recovery of tourism in New Zealand during the COVID-19 pandemic would continue to be led by domestic tourists because of New Zealand is one of the countries has closed international travel and New Zealanders spent their holidays and vacations domestically (Deloitte New Zealand, 2020). However, with the international travel resuming, we anticipate a potential shift in this trend and increasing international tourists also contribute to the recovery of the tourism industry during the post-COVID-19 era. If the New Zealand government can design a mechanism to support better air services to smaller or remote communities, more weekend trips and holidaymakers will be encouraged to enjoy the local nature, culture and history, which may lead to significant boosts in tourist arrivals and visitor spending in smaller regions. It should be noted that the purpose of this funding is to help local communities facilitate their tourism development through subsidised air services. To maintain the efficiency and validity of the subsidy program, the funding mechanism should be more resilient and regularly monitored to remove routes that become financially self-

supporting during the subsidy period.

In Taiwan, the government's interest is to continually make the offshore islands' culture, kaoliang liquor, and nature more accessible to domestic and international tourists (National Development Council, 2016). However, providing sufficient airline seat capacity to transport tourists and holidaymakers between the main island and offshore islands during peak seasons appear to be a serious challenge (Ministry of Transportation and Communications, 2020a). To this point, subsidised routes may provide opportunities for airlines to continue optimising their route capacity, eventually, helping increase tourist numbers and developing more tourism activities in offshore islands. This could be demonstrated by the high load factor of offshore island during the COVID-19 pandemic (ET today, 2021). As none of the Taiwanese participants are associated with the tourism sector and as their major expertise, therefore the results relating to be the tourism factors should be discussed cautiously.

7. Conclusion

With the development of regional air transportation, regional aviation subsidies have been widely discussed. Unlike previous studies, however, this study focused on obtaining preferences, opinions and views from various interested stakeholders that identify the most important wellbeing categories and factors to be considered when forming or improving aviation subsidy policies. The findings of this study, using New Zealand and Taiwan as two case studies, show that *destination served* and *flight frequency* are the key factors when designing or implementing aviation subsidies. It also reveals that integrating *economic wellbeing* and *social wellbeing* into aviation subsidy policy design and implementation is highly necessary. More specifically, *local business activities*, *medical treatment*, and *rapid hazard response* are the top-ranked factors, which need to be prioritised when designing or making changes to their respective regional aviation subsidy policies. In addition, spurring the regional tourism sector does not seem to be the main concern in forming or implementing aviation subsidies. Lastly, environmental concerns have a relatively low priority when considering the issue of regional aviation subsidies.

One reason making this study meaningful is because it provides insights and policy implications for the governments and, regarding the importance of regional wellbeing indicators to aviation subsidy policy formation and implementation. For example, if the New Zealand government wants to provide subsidies to support the regional aviation sector, the government's main strategic option would be to improve the *destinations served* by regional airports and increase *flight frequency* to the regions. For the Taiwanese government, minimum daily flights to offshore islands should remain an important requirement for future aviation subsidy policies. Besides the air transport-related indicators, the regional wellbeing indicators (i.e. economic and social wellbeing indicators, as previously mentioned) are also important, no matter how long the COVID-19 pandemic will persist. Both New Zealand and Taiwanese governments should formulate aviation subsidy policy that could benefit *local business activities*, *medical treatment*, *rapid hazard response*, and *visitor expenditure in the region*. These key indicators are believed to affect the formation and implementation of their respective future aviation subsidy policies in the post-COVID-19 recovery phase. Therefore, both governments should closely consider their regional air connectivity objectives and determine how aviation subsidies can support air services to remote regions and smaller communities, as well as impacting the intended economic, social and environmental wellbeing and stimulating regional tourism development. More importantly, regional aviation subsidy policies should be evaluated periodically against predetermined objectives. In today's dynamic aviation landscape, optimising the efficiency of aviation subsidies is paramount to prevent market distortions and cost inflation (Fageda et al., 2018; Gössling et al., 2017). Transparency and data-driven allocation methods can lead the way, ensuring that aviation subsidies are channelled to

where they are needed most (Papatheodorou & Lei, 2006). Targeting specific routes and regions, adopting performance-based criteria, and conducting regular evaluations can provide a nimble approach to aviation subsidy evaluation and management. Moreover, regular engagement from stakeholders can also enrich the process of aviation subsidy evaluation and management. By adhering to these principles, aviation subsidies can stimulate regional growth, preserve competition, as well as contributing to wellbeing improvement.

The study contributes to the air transport literature by being the first to evaluate the key regional air transport activity and wellbeing indicators to be considered when forming or implementing aviation subsidies. Despite using the FAHP technique, it is important to bear in mind the possible bias in participants' responses, as they are an outcome of the understanding and judgment of the participants being surveyed. Although surveying aviation stakeholders and policymakers can be justified for small samples, such as in this study, it would be even better to extend the sample sizes for more insightful results. For example, it is unfortunate that this study did not include Taiwanese participants with background and expertise in environmental impacts and tourism, as those from New Zealand – this mis-match issue could be remedied in future studies with larger samples. It can also simplify the survey questions (as it is difficult and time-consuming to construct the comparison pairwise matrix) to incorporate mass public opinions into the consideration of regional aviation subsidy policy to be more understanding of this contemporary issue. Further research to empirically quantify the impact of aviation subsidies and regional wellbeing are also important. Moreover, also it is interesting to extend this study to investigate the relationship between aviation subsidies and regional wellbeing in countries that will continuously improve and strengthen their regional air transport development as a national policy.

CRedit authorship contribution statement

Hanjun Wu: Conceptualization, Methodology, Formal analysis, Investigation, Software, Visualization, Writing – original draft, Writing – review & editing. **Yi-Hsin Lin:** Conceptualization, Investigation, Methodology, Validation, Writing – review & editing. **Thanh Ngo:** Conceptualization, Validation, Writing – review & editing. **Kan Wai Hong Tsui:** Conceptualization, Methodology, Supervision, Validation, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

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