



# What are passenger perspectives regarding airlines' environmental protection? An empirical investigation in Taiwan



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## ABSTRACT

Many airlines recognize the importance of environmental protection. The airlines implement a number of environment-friendly activities related to in-flight services and wish to trigger passengers' support and therefore inquire as to their preferences. Because these activities are not identical between airlines, it is not known which items are actually supported and which items are opposed. In this paper, major airline environmental protection activities were collated, and the Smart partial least square software was used to analyse data from 442 passengers who have experienced air travel in the past 3 years. The results showed that in general, passengers would prefer to choose airlines that supported environmental protection activities. However, several activity items would be rejected if passengers felt their rights or interests being compromised. It was also indicated that people from countries at different stages of economic development had varying preferences regarding their support of airlines' environmental protection activities, and the young generation had more concern about environmental protection than others. The findings of this research could be beneficial for airlines setting up their differentiated marketing strategies for enhancing both environmental protection efforts and business performance.

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## 1. Introduction

Environmental protection has become a prominent issue in recent years. Many global campaigns for the environment have been introduced successively to require the participation of countries and corporations in environmental protection efforts. Examples include the 1987 Montreal Protocol to prevent the continued destruction of the ozone layer and the 1997 Kyoto Protocol to reduce the emissions of greenhouse gases (GHG) arising from human activities. Various stakeholders are also showing an increasing interest in whether multinational corporations pay attention to environmental protection (Andersen and Skjoett-Larsen, 2009). One example is the Carbon Disclosure Project (CDP), an organization in the UK, which invites large international corporations to disclose their annual carbon dioxide emissions and environment risk management property and measures these companies' environmental information and reveal this information as reference for investment considerations (CDP, 2014). Increasing numbers of companies, particularly large multinational corporations, are aware

of the importance of being environmentally friendly in regards to their business operations. These companies not only practice environmental protection activities but also present their efforts in their environmental annual reports. These companies' demonstrations to their clients that they minimize and mitigate their environmental impact may provide benefits of competitive advantage over their competitors (Miyoshi and Mason, 2009).

The environmental impacts generated by airlines are comprehensive and increasingly severe. During take-off, landing and taxiing at airports, the aircraft noise and exhaust fumes cause disturbances to local residents and the natural environment (Upham et al., 2003). During flight, pollutants inject into the upper troposphere and lower stratosphere result in a higher level of global warming (Lu, 2009). Due to ground operations, airlines consume natural resources and generate waste. As a result, airlines are considered an important industry that needs to reduce its adverse effects on the environment (Chen, 2013). For example, the European Union included airlines in its emission trading scheme from 2012 (Anger, 2010; Derigs and Illing, 2013); the International Civil Aviation Organization (ICAO) has resolved to implement global market-based measures before 2020 (ICAO, 2013), while the International Air Transport Association (IATA) encourages its member airlines to establish environmental management systems

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(IATA, 2014).

When airlines conduct environment protection, in addition to complying with local and international norms, they are able to reduce costs, enhance business performance, and also establish a good image by emphasizing corporate social responsibility (CSR), thereby garnering greater consumer support. The aforementioned benefits have induced increasingly more airlines to implement various environmental protection activities, such as saving fuel, adopting the ISO14001 environmental management system, and using the ISO14064-1 for their annual inventories of GHG emissions. Additionally, environment-friendly airlines can build a greener image with respect to their competitors and other forms of transport and thus attract and retain customers in the future (Roszkopf et al., 2014).

As websites have become useful platforms for information dissemination, many major international airlines have published the results of their environmental protection activities on their respective websites to establish a good impression among passengers and to gain their support. Due to environmental protection activity items not being identical between airlines, it is not known which items are actually supported by passengers and which are opposed; further research is required.

Moreover, airline passengers may come from different regions, including both developed and developing countries; the former ones launched environmental protection activities in the late 1950s, while the latter ones did so later (Ma, 2011). It remains to be studied whether passengers with varied economic levels have different types of support for airline environmental protection activities.

This research is intended to understand passengers' support towards airlines' environmental protection activities and their willingness to choose environment-friendly airlines as well as the different mindsets between air passengers from developed and developing countries. To comply with this research goal, we selected environmental protection activity items directly related to passenger services from the websites of internationally renowned airlines. The respondents had air travel experience in the past three years. The Smart partial least square (PLS) software was then used for analysis. The results could be used by airlines for strategic planning to enhance their environmental protection efforts and business performance as well as differentiated marketing to deploy in different countries.

Following this introduction, section two introduces the literature related to aviation environmental protection and air passengers' views, leading to the development of the research hypotheses. The methodology is covered in the third section followed by the data analysis, and finally, theoretical and managerial implications are discussed.

## 2. Hypotheses

The airline is one of high-service nature industry, company operators must understand their customers' perceptions. Air passengers usually come from different countries. Pantouvakis and Renzi (2016) mentioned that different national characteristics can affect the customers' perceptions of satisfaction from the service offered. But in terms of environmental protection, it has become a global and a common idea to prevent or mitigate the adverse effects caused by environmental degradation (Kariminia et al., 2013). For reducing the risks and impacts of climate change, around 200 countries agree to hold the increase in the global average temperature to well below 2 °C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5 °C above pre-industrial levels (UNFCCC, 2015). With an increasing worldwide concern for the environment, logistics providers and freight

carriers have started paying more attention to the negative externalities of their operations (Demir et al., 2014). The transportation operators, including passenger-service airlines, not only consider service quality, but also need to take the appropriate environmental protection activities to satisfy their customers.

### 2.1. Airline environmental protection activities and passengers' support and willingness to choose

Forsyth (2011) believed that the primary impact of the aviation industry on the environment is the combustion of fossil fuels by aircraft engines, which produces GHG that in turn cause global warming. Alonso et al. (2014) were concerned that growth in air transport would worsen the impact of energy consumption on the environment. IATA has laid out a four-pillar strategy, with an environmental vision to "build a zero-emissions commercial aircraft within 50 years" (IATA, 2009; Winchester et al., 2013). This four-pillar strategy has guided the direction adopted by most of the world's airlines in terms of their environmental protection activities. The items that are more directly related to passenger services can be grouped into the following three categories: Cabin service and equipment, Flight dispatch and operations, and Inviting passengers to assist.

### 2.2. Cabin service and equipment (CSE)

Airlines select lighter cabin facilities or environment-friendly products, or adjust the cabin service process to reduce unnecessary payload. Examples include reducing the weight of cabin service supplies to reduce fuel consumption; preparing environment-friendly ingredients as passenger food; and encouraging passenger pre-order duty free product through E-shopping before flight to reduce aircraft payload.

Tsai et al. (2014) integrated both Activity-based costing (ABC) and Theory of constraints (TOC) methods, determined that lower aircraft cabin weights could reduce fuel consumption and carbon dioxide emissions during flights. These are conducive to environmental protection and the enhancement of corporate image.

Liou et al. (2011) applied a modified VlseKriterijumska Optimizacija I Kompromisno Resenje (VIKOR) method to understand the gaps between what airlines provide and what customers' seek. Researching to 5553 Taiwan domestic flight passengers, they found the cabin service criteria are considered the most important factor of service quality, because cabin service occupies more of a passenger's travelling time than other aspects of service. Cabin interior and facility are included in the cabin service items. Pang et al. (2014) mentioned that the aircraft cabin issues are playing an increasingly prominent role in influencing the satisfaction of passengers.

Grunert et al. (2014) summarized several researches comments and mentioned that consumers might consider sustainability during food selection. The sustainability information on food products is important when making food choices. In addition, Lita et al. (2014) used PLS and surveyed 200 local tourists in West Sumatra, Indonesia, noted that if hotels and restaurants offered healthy guest rooms and organic food, as well as focused on environmental protection, customers would have a positive and good impression and also be willing to spend more.

### 2.3. Flight dispatch and operations (FDO)

Airlines set a suitable flight plan or operate an economic flight route for fuel saving. Examples include replacing with smaller aircraft due to less check-in passengers; adjusting a suitable taxi speed also saving fuel consumption; and selecting to an economic

cruise speed for saving fuel.

Wei and Hansen (2007) applied Game-theoretic models to analyse airlines choices in both short-haul and long-haul markets. They indicated that for fuel economy and out-of-cost considerations, airlines could replace larger aircraft with smaller ones if the actual demand is less than expected. Hussain et al. (2015) applied a modify SERVQUAL model to investigate 253 air passengers whom from different regions at Dubai International Airport and indicated that passengers are concerned about flight reliability. Reliability is the ability to perform the promised services in a dependable, accurate and fully responsible manner, without negligence and failure. Flight punctuality and reaching the destination within the promised time are the two major items of reliability.

According to Simić and Babić (2015) research, better air traffic management (ATM) could enhance the operational performance which operating at airport, saving the aircraft fuel consumption, thereby reducing carbon dioxide emissions. Tsai et al. (2014) noted that adopting a more optimal cruising speed and altitude could help reduce fuel consumption. Guépet et al. (2016) indicated that the punctuality of aircraft taxi time could limit pollution emissions and improve stakeholders' satisfaction.

#### 2.4. Inviting passengers to assist (IPA)

Airlines invite passengers to join reduce, reuse, or other environmental protection activities. Examples include inviting passengers to voluntarily donate a little money to support the carbon offset; suggest passengers use own headset to reduce resource consumption; and invite passengers to assist cabin crew to classify and recycle the cabin waste.

Van Birgelen et al. (2011) used online survey and PLS method to examine air travel passengers' perception and willingness-to-compensate on carbon dioxide emission. Total 158 respondents, most of were aged 25–34 years old and resided in the Netherlands, provided their response. This research concluded that flight passengers were willing to participate in carbon offsets when they became aware of the impact of carbon dioxide emissions on the natural environment.

Chen (2013) also made a carbon offset scheme survey to 330 air passengers at Taiwan Taoyuan International Airport. Via Structure equation model (SEM) analysis, the results showed that personal norms and positive anticipated emotions have a positive effect on desires, and desires have a positive and significant influence on intentions to participate in carbon offset scheme.

Stefânica and Butnaru (2015) researched the tourists' perception about environment protection in Romania. Most of the respondents believed that the pro-environment attitudes and adequate behaviour could improve the environment, including: lowering power energy and water consumption, waste collection, using less polluting transportation, paying an ecological tax or directing a percentage of income tax to protect the environment in general, etc. Mayer et al. (2012) compared the perceived green image among 12 of airlines, which had regular flights at Liverpool International Airport of the United Kingdom, and conducted a survey of air passengers at this airport. Nearly half of the 612 respondents were able to differentiate between airlines based on their environmental friendliness, and therefore held different green images of the airlines. These environmental friendliness items include: green aircraft, eco-labels, remove excess weight (can be subjected to CSE); more efficient operation, higher load factor, single engine taxi (can be subjected to FDO), and on-board recycling (can be subjected to IPA).

Based on these research results, the following three hypotheses regarding the airlines were proposed:

**H1a.** Passengers positively support these environmental protection activities applied to the CSE.

**H1b.** Passengers positively support these environmental protection activities applied to the FDO.

**H1c.** Passengers positively support these environmental protection activities applied to the IPA.

Ruiz-Mafe et al. (2013) studied 405 passengers who belong to different European countries and purchased air tickets online, and found that the relationship between attitude and purchase intention was positive and significant. Haggmann et al. (2015) also examined 391 EU and US passengers' general attitudes regarding a green image for various airlines. They found the green image of airlines influenced the passengers' airline choice during booking. Moreover, passengers were willing to pay extra for a green image. Chen et al. (2012) investigated 230 Executive Master of Business Administration (EMBA) students in Taiwan. Most all them held managerial positions and had many years of experience in business position. One of the research results was when airlines adopted various measures to protect and benefit the environment, such as reducing air pollution, complying with international and national environmental regulations, using renewable energy, and reducing energy consumption on the ground, these airlines earned the support and loyalty of passengers.

According to these research results, it could be said that passengers are willing to choose airlines when they have a more comprehensive perception of the environmental protection activities of the airlines.

Combining the aforementioned H<sub>1a</sub>, H<sub>1b</sub> and H<sub>1c</sub>, we propose another three hypotheses:

**H2a.** Passengers have a positive willingness to choose these airlines due to their environmental protection activities applied to the CSE.

**H2b.** Passengers have a positive willingness to choose these airlines due to their environmental protection activities applied to the FDO.

**H2c.** Passengers have a positive willingness to choose these airlines due to their environmental protection activities applied to the IPA.

#### 2.5. Air passengers' general views

Harvey et al. (2014) believed that attitudes are of considerable importance in decisions regarding travel behaviour. Mikulic and Prebežac (2011) compared both types of passengers whom carried by full service airlines and low cost carriers operating at Zagreb Airport of Croatia, and found that the image of airlines has a strong impact on customer loyalty. Park et al. (2004) and Chiou and Chen (2010) conducted studies on passengers of full service and low cost airlines, respectively. These researchers determined that if both categories of passengers formed a good impression of the airline, there would be a positive influence on their likelihood of flying with that airline again. A study of public transport passengers in Malaysia by Kamaruddin et al. (2012) showed that there was a significant positive relationship between satisfaction and environment, satisfaction and loyalty, as well as environment and loyalty.

Based on the Theory of planned behaviour (TPB), an individual's behaviour is determined by a combination of his/her intention to engage in that behaviour and his/her perceptions of control over performing the behaviour (Bai et al., 2014). The attitude toward green behaviours positively affects the overall image, and overall image positively affects intention and willingness to pay more (Lita

et al., 2014).

Hence, this finding led to the proposal of the next hypothesis:

**H3.** Passengers' support of an airline's environmental protection activities has a positive impact on their willingness to choose it.

Combine the various research hypotheses stated in Sections 2.1 and 2.2., a new research framework was proposed, as Fig. 1.

### 3. Empirical analysis

#### 3.1. Data collection

The international airlines are based in many countries around the world and include traditional full service airlines (FSA), as well as low cost carriers (LCC) that have emerged in recent years. Lin (2012) listed 38 FSAs from North America, Europe, Latin America, and Asia. These airlines' combined percentage of international operations was 73.35%. Separately, De Wit and Zuidberg (2012) listed 17 major LCCs from Europe and the United States. These 55 airlines were selected for this research. In addition, the top 2 airlines from Oceania, the top 3 airlines from China, a major airline from South Africa, and the top 2 airlines from Taiwan (where this research was based) were included to obtain a total of 63 airlines. At the end of 2012, environmental protection activities directly related to passenger services as published on these airlines' respective websites were extracted. The total number of activities compiled was 45.

Next, a total of 16 experts were invited to complete an expert questionnaire and determine the relevance of the various items related to airlines' environmental protection activities and passenger services. These experts included one officer with over 25 years' experience with the Taiwan Civil Aeronautics Administration; nine senior employees from various airlines, including a vice president of maintenance, a general manager of flight operations, a pilot, a flight attendant, a ticketing staff, an airport service manager, a public relations staff, an environmental manager, and an environmental auditor, each had over 20 years of working experience; three with high frequent flyers, each had over 10 years of flying experience; two academics were subject specialists; and one lawyer dealt with passengers' rights.

These experts were requested to score the relevance of each item with 0–4 points, representing the following 5 categories of relevance, respectively: no association, weak, moderate, strong, and

extremely strong. Next, 21 items with scores higher than the arithmetic mean were selected to comprise the questionnaire (Table 1).

The formal questionnaires were prepared in four languages: traditional Chinese, simplified Chinese, English and Japanese. Format-wise, the questionnaire was divided into two parts. The aforementioned 21 items were listed in the first part. Respondents were asked to state their level of support for each by using a Likert 5-point scale and were also asked to rate their overall level of support for airlines' environmental protection activities and their willingness to choose such airlines. In the second part, respondents were asked to fill in their personal details, including gender, age, nationality, educational qualification, and occupation.

The questionnaires were distributed at various locations where people of different nationalities congregate, including the arrival hall of Taiwan Taoyuan International Airport, as well as the urban areas in Taipei. The respondents had to have experienced air travel in the past three years. The questionnaires were retrieved on the spot after completion. Approximately 1000 questionnaires were distributed between January and March 2013 and 808 copies were retrieved, of which 442 (54.70%) were deemed to be valid. The basic information of the respondents is categorized in Table 2.

#### 3.2. Grouping

The SPSS version 12.0 was used for the first step of raw data analysis. Factor analysis method with loading factor 0.3 was selected, and 3 factors were extracted according to the classification of this research. The item of  $A_{01}$ ,  $A_{07}$ , and  $A_{17}$  were deleted in this step.

Subsequently, the Smart PLS version 2.0 software was applied. PLS was introduced by Herman Wold in 1975. The PLS model consists of a structural part, which reflects the relationships between the latent variables, and a measurement component, which shows how the latent variables and their indicators are related (Haenlein and Kaplan, 2004). It is suitable for small sample sizes, non-normal data, both reflective and formative constructs, etc (Urbach and Ahlemann, 2010; Ringle et al., 2012). PLS can be an adequate alternative to covariance-based Structural Equation Model (SEM) if the phenomenon to be investigated is relatively new and measurement models need to be newly developed (Urbach and Ahlemann, 2010). The Smart PLS software containing with graphical interface can be used in empirical research to analyse collected data and test hypothesized relationships.

The test of validity on the indicators used the software of PLS to evaluate convergence and discriminate validity. In accordance with the experience of Urbach and Ahlemann (2010) and Lita et al. (2014), the convergent validity is considered high if the indicator loading value is above 0.7, or between 0.5 and 0.7 as long as its average variance extracted (AVE) value is above 0.5. In addition, the both values of composite reliability (CR) and Cronbach's alpha (CA) must not be lower than 0.6.

In this research, the path weight scheme method of Smart PLS was applied, and the indicator loading values higher than 0.6 were selected. The following 3 groups were distributed:

- CSE: Comprising Items  $A_{08}$ – $A_{13}$ ;
- FDO: Comprising Items  $A_{03}$ – $A_{06}$ ;
- IPA: Comprising Items  $A_{15}$ , and  $A_{19}$ – $A_{21}$ .

The AVE values of all 3 groups exceeded or very close to 0.5. The square root of each AVE was greater than the corresponding correlation value of the other dimensions. All the Cronbach's alpha values were greater than 0.6, and the composite reliability (CR) values were greater than 0.7. These results indicated that the

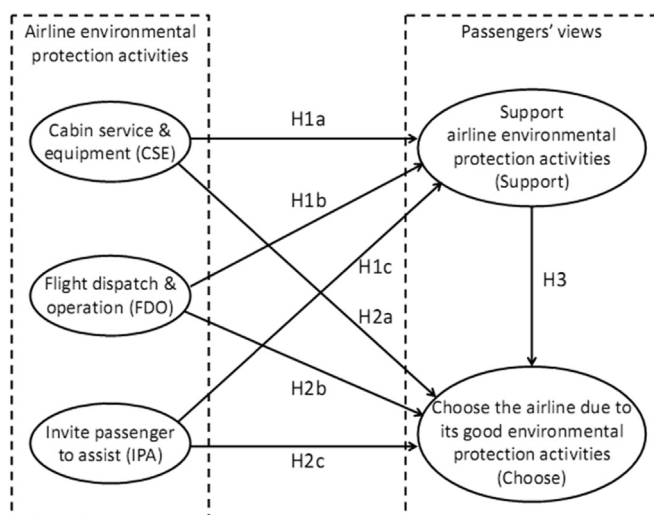


Fig. 1. Research framework.

**Table 1**  
The 21 selected question items.

No.	Item
A <sub>01</sub>	Use an E-ticket to replace the paper-ticket
A <sub>02</sub>	Use differentiated fare structure as an incentive for check-in passengers to achieve a reduction in luggage weight
A <sub>03</sub>	Change to smaller and fuel-saving aircraft, if less check-in passengers
A <sub>04</sub>	Adjust passenger seat location to reach a fuel-saving performance
A <sub>05</sub>	Reduce aircraft taxi time; to save fuel consumption
A <sub>06</sub>	Select fuel-saving flight speed, although arrival time would be slightly delayed
A <sub>07</sub>	Use lighter in-flight service products (e.g., metal cutlery replaced with light plastic ones) to reduce aircraft total weight
A <sub>08</sub>	Adjust aircraft toilet faucet water outflow to save water and reduce its weight
A <sub>09</sub>	Reduce small bottled water or soft drinks to decrease waste
A <sub>10</sub>	Use Eco product on board, e.g., hand soap, tissue
A <sub>11</sub>	Use air entertainment system to display daily or hot news to replace a portion of newspapers and magazines to reduce paper consumption
A <sub>12</sub>	Use locally sourced produce for passengers food for CO <sub>2</sub> reduction
A <sub>13</sub>	Use environment-friendly ingredients as passenger food
A <sub>14</sub>	Encourage passenger pre-order duty free product through E-shopping before flight to reduce aircraft payload
A <sub>15</sub>	Suggest passengers choose meal before flight to prevent food wastage
A <sub>16</sub>	Suggest passengers use own headset to reduce resource consumption
A <sub>17</sub>	Invite passengers to assist cabin crew to classify and recycle the cabin waste, e.g., newspaper, paper cup, soft drink cans
A <sub>18</sub>	Less aircraft TV equipment but provide Wi-Fi internet to encourage passenger watch loving program via personal cellular phone or pad
A <sub>19</sub>	In summer, ask passengers to close the cabin window shade before disembarking to decrease cabin temperature
A <sub>20</sub>	Speed up passenger boarding and disembarking to reduce ramp operation time to save electricity and fuel consumption
A <sub>21</sub>	Invite passengers to voluntarily donate a little money to fund and construct greener facilities, e.g., tree planting, solar and wind power

**Table 2**  
Categories of respondent background.

No.	Classification and attributes/distribution	Sample number	
P <sub>01</sub>	Gender	Male	206
		Female	236
P <sub>02</sub>	Age	Below 30	245
		Between 31 and 50	97
		Above 51	100
P <sub>03</sub>	Citizenship	Developed country	133
		Developing country	103
		Taiwan	206
P <sub>04</sub>	Education	High school or below	83
		University/college	266
		Master/doctor	93
P <sub>05</sub>	Occupational status	Incumbent	154
		Homemaker/retiree	67
		Student	221

**Table 3**  
Loading values (higher than 0.6 as bolded) analysed via Smart PLS.

	CSE	FDO	IPA	Support	Choose
A <sub>03</sub>	0.314	<b>0.677</b>	0.307	0.148	0.150
A <sub>04</sub>	0.386	<b>0.789</b>	0.369	0.184	0.228
A <sub>05</sub>	0.371	<b>0.720</b>	0.402	0.142	0.147
A <sub>06</sub>	0.415	<b>0.688</b>	0.367	0.175	0.184
A <sub>08</sub>	<b>0.630</b>	0.349	0.338	0.209	0.239
A <sub>09</sub>	<b>0.692</b>	0.336	0.357	0.208	0.218
A <sub>10</sub>	<b>0.788</b>	0.373	0.382	0.298	0.288
A <sub>11</sub>	<b>0.713</b>	0.381	0.397	0.247	0.187
A <sub>12</sub>	<b>0.713</b>	0.388	0.449	0.230	0.179
A <sub>13</sub>	<b>0.740</b>	0.397	0.437	0.293	0.215
A <sub>15</sub>	0.398	0.374	<b>0.654</b>	0.222	0.165
A <sub>19</sub>	0.429	0.361	<b>0.754</b>	0.226	0.230
A <sub>20</sub>	0.419	0.367	<b>0.774</b>	0.307	0.199
A <sub>21</sub>	0.293	0.310	<b>0.622</b>	0.205	0.203
Support	0.351	0.228	0.345	<b>1.000</b>	0.355
Choose	0.314	0.252	0.283	0.355	<b>1.000</b>

categorization results were in line with the requirements of PLS. The details are shown in Tables 3 and 4.

## 4. Results

### 4.1. Analysing results

Based on the categorizations in Table 4, the bootstrapping method of Smart PLS was used for continuous analysis. In accordance with the suggestion of Sarstedt et al. (2011), the individual change was selected with the sampling set at 5000; and the t-value of each path was used for the significance test (Lita et al., 2014). The results are presented in Fig. 2 and Table 5, as

- All the t-values of H<sub>1a</sub>, H<sub>1c</sub> and H<sub>3</sub> were greater than 3.29 (p < 0.001), and the t-value of H<sub>2a</sub> was greater than 1.96 (p < 0.05), indicating that the respective constructs were significantly supported.
- The other t-values of H<sub>1b</sub>, H<sub>2b</sub> and H<sub>2c</sub> were lower than 1.96, indicating that the respective constructs were not significantly supported.

Next, the bootstrapping method of Smart PLS was continuously used to analyse whether there was a difference between

respondents from developed and developing countries in terms of the items of airlines' environmental protection activities that they supported. Because Taiwan is not a member state of the United Nations and its economic situation and development in environmental protection are between that of developed and developing countries, the results of the specific analysis could be used for verification of the variations. The results were presented in Table 6, as

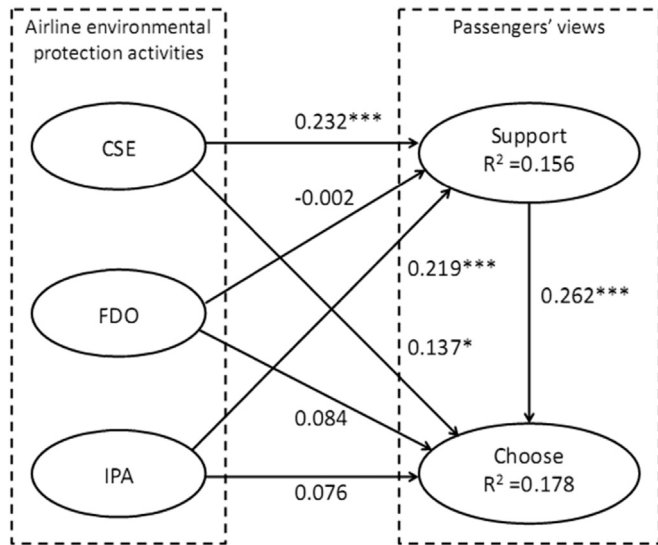
- For developed counties, only the H<sub>2a</sub> (t-value was greater than 1.96) was significantly supported (p < 0.05).
- For developing counties, only the H<sub>1c</sub> (t-value was greater than 1.96) was significantly supported (p < 0.05).
- For Taiwan, both the H<sub>1a</sub> (t-value was greater than 3.29) and H<sub>1c</sub> (t-value was greater than 1.96) were significantly supported (p < 0.001 and p < 0.05, respectively).

Since this researching investigation was held across winter vacation, half of the respondents were students. Via t-test we found the significant difference was existed between group of students and group of non-students (incumbent and homemaker/retiree). A further bootstrapping method of Smart PLS analyse was required. The results were presented in Table 7, as

**Table 4**  
Inter-construct correlations: consistency and reliability test.

	AVE	Composite reliability	Cronbach's alpha	CSE	FDO	IPA	Support	Choose
CSE	0.510	0.861	0.807	<b>0.714<sup>a</sup></b>				
FDO	0.518	0.811	0.692	0.518	<b>0.720<sup>a</sup></b>			
IPA	0.496	0.796	0.658	0.548	0.500	<b>0.704<sup>a</sup></b>		
Support	1.000	1.000	1.000	0.351	0.228	0.345	<b>1.000<sup>a</sup></b>	
Choose	1.000	1.000	1.000	0.314	0.252	0.283	0.355	<b>1.000<sup>a</sup></b>

<sup>a</sup> Square root of the AVE on the diagonal.



**Fig. 2.** Structure model result by smart PLS. \* Represents significant level: \*:  $p < 0.05$ ; \*\*:  $p < 0.01$ ; \*\*\*:  $p < 0.001$ .

- For students, all the  $H_{1a}$ ,  $H_{2a}$  and  $H_{2b}$  (three t-values were greater than 3.29), and the  $H_{1b}$  (t-value was greater than 2.58) were significantly supported ( $p < 0.001$  and  $p < 0.01$ , respectively).

**Table 5**  
Structure model result.

Hypothesis (path)	Path coefficient	Standard error	t-value	Supported
$H_{1a}$ CSE → Support	0.232	0.057	4.051***	Yes
$H_{2a}$ CSE → Choose	0.137	0.060	<b>2.260*</b>	Yes
$H_{1b}$ FDO → Support	-0.002	0.035	0.054	No
$H_{2b}$ FDO → Choose	0.084	0.052	1.605	No
$H_{1c}$ IPA → Support	0.219	0.059	<b>3.735***</b>	Yes
$H_{2c}$ IPA → Choose	0.076	0.052	1.456	No
$H_3$ Support → Choose	0.262	0.051	<b>5.093***</b>	Yes

\* Represents significant level: \*:  $p < 0.05$ ; \*\*:  $p < 0.01$ ; \*\*\*:  $p < 0.001$ .

**Table 6**  
Different support conditions by people of developed and developing countries.

Hypothesis (path)	Developed counties		Developing counties		Taiwan	
	t-value	Supported	t-value	Supported	t-value	Supported
$H_{1a}$ CSE → Support	1.478	No	1.434	No	4.040***	Yes
$H_{2a}$ CSE → Choose	<b>2.313*</b>	Yes	0.882	No	0.290	No
$H_{1b}$ FDO → Support	0.367	No	0.269	No	0.125	No
$H_{2b}$ FDO → Choose	0.150	No	1.906	No	0.947	No
$H_{1c}$ IPA → Support	1.281	No	<b>2.655**</b>	Yes	<b>2.413*</b>	Yes
$H_{2c}$ IPA → Choose	0.666	No	1.178	No	1.545	No
$H_3$ Support → Choose	<b>2.828**</b>	Yes	<b>2.638**</b>	Yes	<b>3.552***</b>	Yes

\* Represents significant level: \*:  $p < 0.05$ ; \*\*:  $p < 0.01$ ; \*\*\*:  $p < 0.001$ .

**Table 7**  
Different support conditions by people of students and non-students.

Hypothesis (path)	Students		Non-students	
	t-value	Supported	t-value	Supported
$H_{1a}$ CSE → Supported	9.369***	Yes	1.344	No
$H_{2a}$ CSE → Chosen	<b>5.254***</b>	Yes	<b>2.963**</b>	Yes
$H_{1b}$ FDO → Supported	<b>2.664**</b>	Yes	1.036	No
$H_{2b}$ FDO → Chosen	<b>9.488***</b>	Yes	1.058	No
$H_{1c}$ IPA → Supported	1.221	No	<b>3.807***</b>	Yes
$H_{2c}$ IPA → Chosen	1.677	No	0.744	No
$H_3$ Support → Choose	<b>2.627**</b>	Yes	<b>3.743***</b>	Yes

\* Represents significant level: \*:  $p < 0.05$ ; \*\*:  $p < 0.01$ ; \*\*\*:  $p < 0.001$ .

- For non-students, the  $H_{2a}$  (t-value was greater than 2.58) and the  $H_{1c}$  (t-value was greater than 3.29) were significantly supported ( $p < 0.01$  and  $p < 0.001$ , respectively).

4.2. Discussion

In general, passengers prefer to choose airlines that support environmental protection activities, but not all items included in the activities were supported.

When airlines apply measures to CSE (e.g., reduce aircraft weight, use eco-products), these items could be personally perceived or experienced by passengers as being beneficial to the Earth's ecology and their personal health. Hence, they would

support these items and consequently be more willing to choose the airlines.

Passengers were also willing to assist airlines in their IPA (e.g., recycle cabin waste, donate for carbon offset). However, doing this did not increase their willingness to choose the airlines. This could be because passengers currently already grasp the concept of environmental protection and are willing to support and participate within their means, but will not use this as the sole criterion for decision-making.

However, passengers generally did not support the inclusion of FDO items and were unwilling to choose the airlines based on this factor. The reason could be concern over their rights or interests being compromised by, for example, being made to change to a smaller aircraft or the seating arrangements or a longer flight duration.

Regarding variations in terms of nationality, people from developed countries showed willingness to choose the airlines, although they did not fully support the CSE. On the other hand, people from developing countries showed support for IPA, but did not increase their willingness to choose the airlines. It can thus be observed that regarding support for airlines' environmental protection activities, variations did exist among people from countries at different stages of economic development.

Apart the students and non-students, the group of students showed support and willingness to choose for both CSE and FDO, but the group of non-students showed support for IPA and willingness to choose for CSE. It can be explained that the students had more concern about airlines environmental protection than others, and care the environment more than their personal rights or interests.

## 5. Conclusions

In the era of less business profit and environmental protection issues being important, airlines must protect our nature earth and try to increase the business revenue. If airlines can grasp the global trend, detect passengers' views about this issue ahead of time, and establish a farsighted environment-friendly marketing strategy to trigger their support, they will have good business performance and will also improve the sustainability of our earth. It is as Forsyth (2011) mentioned, "For air transport, environmental and financial sustainability can be achieved together, as long as efficient policies are adopted".

In this research, the airline environmental protection activity items which related to passenger services from major international airlines' websites have been collated for generating the questionnaire to obtain feedback from passengers who have had air travel experience within the past three years. Next, we conducted an effective analysis with the Smart PLS software to study passengers' views about their support and choice willingness when they have a more comprehensive perception of the environmental protection activities of the airlines. Moreover, the variations among people from countries at different stages of economic development, as well as the young generation mindset had been reviewed.

According to the research results, it was indicated that in general passengers prefer to choose airlines that support environmental protection activities, so airlines can show their efforts in environmental protection performance as part of their marketing promotion strategies and thus attract more passengers who have strong concepts of environmental protection. Furthermore, airlines can consider extending several popular activities to expand the advantage. For example, demonstrate the total amount of fuel saving and CO<sub>2</sub> reduction via air magazine, entertainment or company web to present the environmental protection performance; introduce any favorable knowledge for passenger (e.g.,

luggage weight reduction method) on the web to increase good image, also saving aircraft fuel consumption; extend the pre-selection meal scope from first/business class to all cabins, more ingredients won't be wasted and the aircraft payload can be reduced, too.

However, several environmental protection activity items were rejected if passengers felt their rights or interests being compromised. Thus, airlines must retain service quality at the same time they implement environmental protection operations. For example, make a clear announce to get passengers' understanding if select fuel-saving flight speed causing arrival time would be slightly delayed.

Although the importance of environmental protection has been recognized in the world, it was also indicated that people from countries at different stages of economic development had varying preferences for airlines' environmental protection activities. The people from developed countries preferred CSE, another people from developing countries preferred IPA. The specific finding could encourage airlines to implement their differentiated marketing strategies. They can try to promote different environmental protection items in different region, to increase the customers' interest.

We also found the group of student (could be said young generation) had more attention about environmental protection than others; therefore, airlines do not only consider current passenger demands, but also need to care about the latent customers' concerns. It is recommended that airlines must aware the important trend while setting their long term marketing strategy.

Due to environmental protection activities conducted by airlines throughout the world are not completely identical and many items are technically specialized, it was not easy to list all the associated items and ask the respondents to understand them and select from among them in a few minutes. Thus, only some of the representative items that were easily understood by the general public were selected.

This research made use of actual environmental protection activity items, as disclosed by airlines. Although our approach was rarely employed in the literature review, the findings are useful and practical for airlines to increase their business performance directly, improve the sustainability of our earth, and are also applicable to other researchers in their subsequent studies.

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