Sustainability **2015**, *7*, 7762-7783; doi:10.3390/su7067762

OPEN ACCESS

sustainability

ISSN 2071-1050

www.mdpi.com/journal/sustainability

Article

Identifying Strategic Factors of the Implantation CSR in the Airline Industry: The Case of Asia-Pacific Airlines

Dong-Shang Chang [1], Sheng-Hung Chen [1], Chia-Wei Hsu [1,2,*] and Allen H. Hu [3]

[1] Department of Business Administration, National Central University, Taoyuan City 32001, Taiwan; E-Mails: changds@mgt.ncu.edu.tw (D.-S.C.); m95124003@gmail.com (S.-H.C.)

[2] Department of Travel and Eco-tourism, Tungnan University, New Taipei City 222, Taiwan

[3] Institute of Environmental Engineering and Management, National Taipei University of Technology, Taipei 10608, Taiwan; E-Mail: allenhu@mail.ntut.edu.tw

***** Author to whom correspondence should be addressed; E-Mail: jcwhsu@mail.tnu.edu.tw or 103481017@cc.ncu.edu.tw; Tel.: +886-2-8662-5958 (ext. 734); Fax: +886-2-8662-5957.

Academic Editors: Marc A. Rosen and Giuseppe Ioppolo

Received: 1 March 2015 / Accepted: 11 June 2015 / Published: 17 June 2015

Abstract: Sustainable development has always been the objective of many fields, including the tourism and transportation sector. However, a major part of this sector, the airline industry, deals with many negative impacts, such as air pollution, noise, CO_2 emission, and labor practice. Corporate social responsibility (CSR) is a strategic business activity that can enhance the sustainability of the airline industry. The results of the Dow Jones Sustainability Indices (DJSI) reveal that airlines of Western countries exhibit a more remarkable CSR performance than Asia-Pacific airlines, suggesting that the CSR programs of Asia-Pacific airlines need improvement. By constructing an evaluation hierarchy and applying the decision-making trial and evaluation laboratory (DEMATEL) method, this study found that the key strategic factors in the airline industry's implementation of CSR include corporate governance, risk and crisis management, brand management, and product responsibility (safety).

Keywords: Sustainable Development Airline industry; DEMATEL; Corporate Social Responsibility

---

1. Introduction

The airline industry is a part of the service sector that plays an important role in the tourism and transportation industry. At present, the airline industry is operating in a competitive environment [1], with corporate social responsibility (CSR) being the source of competitive advantages [2]. CSR contributes to the long-term value of an airline; this notion is consistent with the Friedmanesque view that airline "executives may consider practicing socially responsible activities… because such practices appear to be accompanied with an increase in their companies' value [over the long-term], which is the ultimate goal of any corporation" [3]. In addition, the effects of CSR on customer loyalty, as well as its identification of areas needing emphasis in terms of organizational involvement and support, has also improved [4]. Cowper-Smith and Grosbois [5] stated that the airline industry has received considerable attention from both the public and academia in regards to CSR issues because of the industry's role in tourism development and its significant environmental and social impacts. As such, CSR has become a critical strategy of airlines, regardless of positive or negative cause.

The CSR of different industries has received a great deal of attention in recent years. As such, CSR rating indices have been developed for evaluating the CSR performance of corporations; one of the most prominent sustainability indices is the Dow Jones Sustainability Indices (DJSI) [6]. Assessment of the 2014 DJSI survey of 16 airlines (62% of the 26 airlines that were invited to participate) showed that the sampled airlines exhibited a market capitalization of 66%. The average score of the airline industry was lower than that of all of the participating industries [7], indicating that the CSR performance of the airline industry could still be improved. The leading companies in the airline industry are from Western countries. By contrast, the rankings reveal that the airlines in Asia-Pacific countries exhibit poor CSR performance. The possible reason for such finding is that the concept of CSR originated from Western countries, and the Asia-Pacific region is just starting to adopt the practice.

The successful implementation of a comprehensive CSR strategy requires many resources and changes of organization, whether cross-functional collaboration or basic thinking on daily work. Therefore, the main purpose of this research is to construct an evaluating model for airlines in Asia-Pacific that can examine the importance and interrelationship of each CSR issue. The evaluation hierarchy developed in this research not only includes basic CSR issues but also covers the specific issues of the airline industry in Asia-Pacific. To ensure comprehensiveness and suitability to airlines, the proposed evaluation hierarchy was based on the main criteria of the DJSI assessment and the mapping of the most representative guidelines or critical regulations of CSR issues in the airline industry, such as Global Reporting Initiative (GRI) G3.1 [8], GRI G4 [9], International Air Transport Association (IATA) [10], and International Civil Aviation Organization (ICAO) [11].

Numerous criteria and dimensions related to the CSR of the airline industry should be considered at the same time. This research applied the Decision-Making Trial and Evaluation Laboratory (DEMATEL) method to deal with causal relationships among the evaluation criteria in the CSR strategy of the airline industry. The DEMATEL method has been successfully applied in many situations, such as airline green supply chain selection, risk assessment, and CSR problems [12–19]. The result of the DEMATEL method is a visual map that includes the relation of the criteria and the relative importance within the evaluation hierarchy. The results of this study can help the airline industry identify the key CSR issues for efficient resource allocation in the planning of CSR strategies.

The remainder of this paper is organized as follows. Section 2 introduces the definition of CSR and previous studies on CSR in the airline industry. Section 3 discusses the CSR issues of the airline industry and introduces the characteristic evaluation criteria. Section 4 presents a brief introduction of the DEMATEL method and proposes the establishment of a model for the DEMETAL method. Section 5 provides the results of the analysis. Section 6 presents the conclusions drawn in this paper and suggests future research directions.

2. Literature Review

2.1. Definition of Corporate Social Responsibility (CSR)

In the past decade, CSR has been the primary subject of a limited number of studies from a small academic community of practice and these studies have primarily focused on three macrolevel topic areas: implementation; the economic rationale for acting more responsibly; and the social relations of CSR [20]. Both academics and practitioners have explored concepts similar to CSR, such as corporate social performance (CSP), corporate sustainability (CS), and environmental management (EM) [21]. Nonetheless, this paper is not concerned with providing precise definitions. According to Elkington [22], the definition of CSR can be broken down into three main aspects: equity–social concerns, ecological–environmental considerations, and economic mergers. The World Business Council on Sustainable Development (WBCSD) has proposed a more extensive definition of CSR: "Corporate social responsibility is the continuing commitment by business to contribute to economic development while improving the quality of life of the workforce and their families as well as of the community and society at large" [23]. Although CSR has different definitions, the basic idea of CSR is to examine how businesses integrate stakeholder interests with social values in order to consolidate the relation between organization and society [24].

2.2. CSR in the Airline Industry

Although many studies have explored the airline industry, few have focused on this industry's CSR activities. Coles *et al.* [20] presented a review of tourism and CSR that compared recent academic research on CSR in the tourism sector. The research indicated that in the tourism sector, the airline industry attracts the most academic attention. The reasons for this include the industry's contributions to climate change and the fact that airlines have several characteristics similar to those of manufacturing industries: intense regulation, high entry barriers, high capital costs, and tendencies toward oligopolies [25]. At present, studies on the CSR of the airline industry is more focused on cost assessment [18], benefits quantitative assessment [3,26,27], CSR motivations [25] and CSR reporting [28,29], but less on CSR strategic factors.

3. CSR Issues of the Airline Industry

The airline industry plays an important role in the tourism sector, thus encouraging the airline industry to live up to the high expectations in regards to CSR practices. The airline industry induces not only environmental effects but also economic and social effects. As Coles *et al.* [20] pointed out, the airline industry is more concerned with environmental issues than its economic or social implications [3].

By analyzing the relationship of sustainability scores and financial performance of 311 firms, Chang and Kou [30] showed that improved sustainability tends to positively influence firm profitability. Coles *et al.* [20] reviewed the relationship between tourism and CSR, and they mentioned that CSR performance can enhance the profitability and value of firms. Lee and Park [3] also investigated the same relationship for airline companies.

An average airline company publishes CSR sustainability reports or sustainable development reports to reflect on its economic, environmental, and social contributions along with the numerous sustainable issues. Hsu [14] stated that the key concept of a CSR report is stakeholder engagement. A sustainability report presents the progress of managerial efforts to enhance the company in society and to communicate their achievements to stakeholders. However several guidelines are observed in preparing sustainable reports, including GRI G3.1, GRI G4, ISO 26000, and SA 8000, which also provide enterprises with a basic framework when working on sustainable reports. These guidelines provide a clearer examination of sustainable development; however, these guidelines are applicable to all industries. Therefore, some specific issues related to the airline industry are not included.

The airline industry-specific CSR issues are evaluated with sustainable evaluation indices or CSR rating systems. Such systems include the DJSI, FTSE KLD 400 Social Index, and FTSE4GOOD Global Index [24]. The most prominent sustainability index is the DJSI, as shown in a survey of more than 1000 sustainability professionals as a part of the Rate the Raters project, which found that the DJSI showed the highest credibility of 16 well-established ratings [6]. The individual questionnaire of the DJSI may be used for many different industry groups; however, the airline industry deals with specific issues, including fleet management, efficiency, reliability, biofuel, and noise [7].

The IATA is the global trade association for airlines. It represents 240 airlines, or 84% of the total air traffic. IATA is an organization that supports many areas of aviation activity and helps formulate industry policy on critical aviation issues [10]. IATA has enumerated several issues related to sustainable aviation, including safety, climate change, aircraft noise, and local air quality.

The other major organization of the aviation industry is the ICAO, which is a UN specialized agency. It works with the convention's 191 signatory states, as well as with global industry and aviation organizations to develop international standards and recommended practices (SARPs), which were used by the United States during the development of their legally binding national civil aviation regulations. The ICAO 2013 environmental report also mentioned aircraft noise, local air quality, and global emissions. The present study collected the CSR issues of the airline industry for DJSI, GRI G4, IATA, and ICAO, as shown in Figure 1.

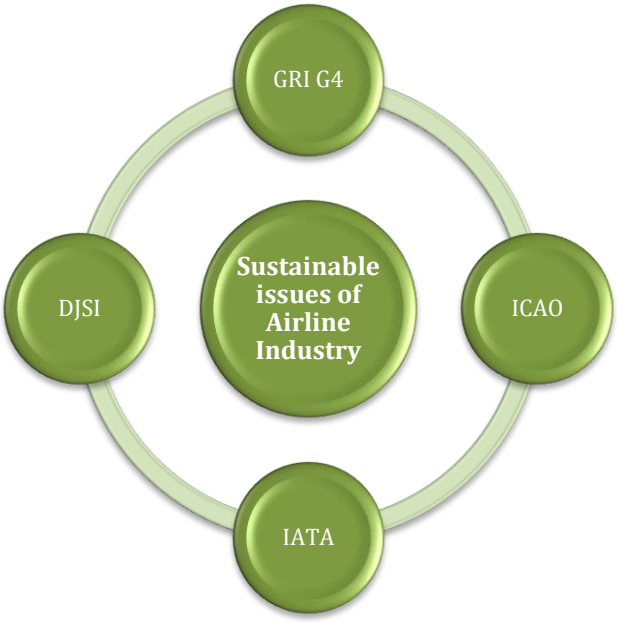

Figure 1. CSR issues of airline industry.

This research collated the key airline CSR issues. In addition, this research used the DJSI airline industry criteria as the basis for mapping the GRI guidelines [8,9], ITAT [10] and ICAO [31] requirements, and mapping the Carbon Disclosure Project (CDP) [32], United Nations Global Compact (UNGC) [33], and International Labor Organization's (ILO) initiatives [34] or regulations that are related to CSR. These initiatives helped in the construction of the evaluation hierarchy of airline CSR issues. A total of 22 evaluation criteria were built on the basis of the DJSI's airlines sector evaluating criteria and the integration of GRI G3.1, GRI G4.0, CDP, UN GC, IATA and ICAO's requirements, as shown in Table 1.

Table 1. Evaluation Hierarchy of Airline Industry CSR Issues.

Dimension		Criteria	Definition	Source
Economic Dimension	EC1	Corporate Governance	Board structure, responsibilities and committees, corporate governance policy, board diversity, board effectiveness, audit conflict of interest, and transparency of senior management remuneration	Dow Jones Sustainability Indices (DJSI), Global Reporting Initiative (GRI)
	EC2	Risk and Crisis Management	Analysis of risks, risk correlation, sensitivity analysis and stress testing, risk response strategy, and crisis preparedness	DJSI, GRI
	EC3	Codes of Conduct/ Compliance/Corruption and Bribery	Focus issues, scope of policy, systems/procedures, business relationships, and reporting on breaches	DJSI, GRI G4 (Society)
	EC4	Antitrust Policy	Antitrust policy, coverage of antitrust policy, antitrust compliance, and reporting process *etc.*	DJSI, GRI G4 (Society)
	EC5	Customer Relationship Management	Satisfaction measurement, customer feedback process, availability of data to the customer center, analysis of customer value, and complaints management	DJSI
	EC6	Brand Management	Brand-related expenses, branding strategies, brand metrics used, and stakeholder perception analysis	DJSI, GRI G4 (Market Presence)
	EC7	Supply Chain Management	Awareness, risk analysis, risk management measures, supply chain management strategy, and transparency	DJSI, GRI G4 (Procurement Practices)
	EC8	Efficiency *	Passenger load factor and share of short-haul flights	DJSI
	EC9	Fleet Management *	Fleet age, measures for improving fuel efficiency	DJSI
	EC10	Reliability *	Arrival delay indicators and management approach	DJSI

Note:* is the airline specific criteria

Table 1. *Cont.*

Dimension		Criteria	Definition	Source
Environmental Dimension	EN1	Climate Change	Direct GHG emissions, indirect GHG emissions, and energy consumption	DJSI, Carbon Disclosure Project (CDP), GRI, International Civil Aviation Organization (ICAO), International Air Transport Association (IATA)
	EN2	Biofuel */Alternative Energy	Biofuel usage volume, research program participation, and ground alternative energy usage	DJSI, CDP, GRI, ICAO, IATA
	EN3	Noise *	Noise management approach and reduction of project and investment	ICAO, IATA
	EN4	Environmental Policy/Management System	Coverage of corporate requirements/guidelines, centralized data collection system, environmental management system (EMS) is verified/audited/certified	DJSI, UN GC, GRI G3.1; G4
	EN5	Operational Eco-Efficiency	Water usage, waste generation, NOx emissions, and SOx emissions	DJSI, CDP, GRI, ICAO, IATA
Social Dimension	SO1	Environment and Social Reporting (Information Disclosure)	Quality of social and environment reporting, materiality, coverage, assurance, and quantitative data	DJSI
	SO2	Labor Practice Indicators and Human Rights	ILO- and UNGC-related indicators, human rights, labor practices, and decent work	DJSI, GRI G4 (Human Rights, Labor Practices, and Decent Work), ILO, UNGC
	SO3	Human Capital Development	Skill mapping and developing process, human capital performance, and learning and development process	DJSI, GRI G4 (Labor Practices and Decent Work)
	SO4	Talent Attraction and Retention	Salary structure, employee turnover rate, and employee satisfaction	DJSI, GRI G4 (Labor Practices and Decent Work)
	SO5	Corporate Citizenship and Philanthropy	Group-wide strategy, performance management process, and KPI	DJSI, GRI G4 (Society)
	SO6	Stakeholder Engagement	Stakeholder engagement approach, materiality analysis process, and feedback approach	DJSI, GRI
	SO7	Product Responsibility (Safety)	Safety management approach, training system, management process, and audit and safety performance	GRI, ICAO, IATA

Note:* is the airline specific criteria.

4. Research Method

DEMATEL is a comprehensive method for building and analyzing a structural model involving causal relationships between complex factors [35]. Developed by the Science and Human Affairs Program of the Battelle Memorial Institute in Geneva between 1972 and 1976, it has been used for studying and solving the complicated and intertwined group of problems. DEMATEL was developed in the belief that pioneering and appropriate use of scientific research methods could improve understanding of the specific *problematique* (the cluster of intertwined problems) and contribute to the identification of workable solutions by a hierarchical structure. The methodology, according to the concrete characteristics of objective affairs, can confirm the interdependence among the variables/attributes and restrict the relationship that reflects the characteristic with an essential system and development trend [36–39]. The end product of the DEMATEL process is a visual representation—an individual map of the mind—by which the respondent organizes his or her own action in the world.

The steps of the DEMATEL method are shown in Figure 2. First, the evaluation hierarchy is constructed. Then, an expert team is selected to apply the expert questionnaire. Then, the DEMATEL method is used to calculate (the detailed calculation steps of the DEMATEL method are summarized below) the matrix of total relation. Finally, r and c are calculated for the degree of influence, and $r + c$ and $r - c$ are calculated to draw the influence map of the total relationship.

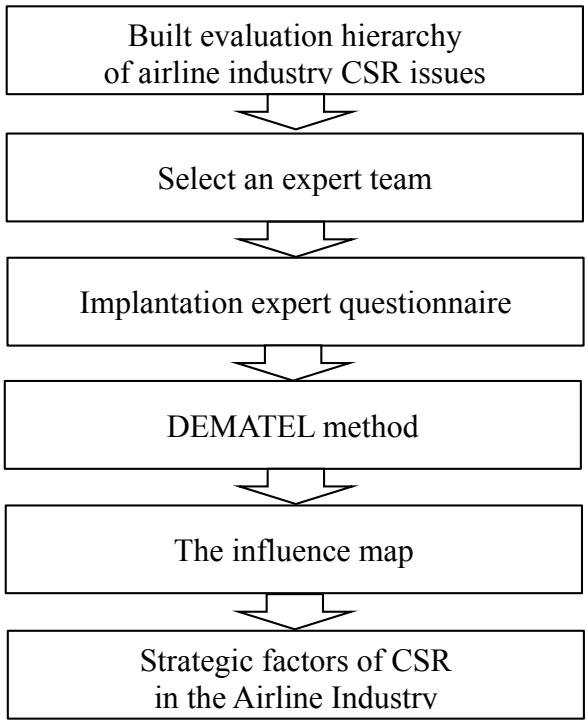

Figure 2. DEMATEL method apply process.

According to Tsai and Hsu [18], Hsu *et al.* [38] and Tzeng *et al.* [40], the DEMATEL method can be summarized in the following steps.

Step 1: Find the average matrix. Assuming H experts are surveyed in this study and n factors are to be considered, each stakeholder is asked to indicate the degree to which he or she believes a factor i affects factor j. These pairwise comparisons between any two factors are denoted by aij and are given

an integer score of 0, 1, 2, 3, and 4, representing "no influence," "low influence," "medium influence," "high influence," and "very high influence," respectively. The scores by each expert yield a $n \times n$ non-negative answer matrix $\boldsymbol{X}^k = [x_{ij}^k]$, with $1 \le k \le H$. Thus, X^1, X^2,…, X^H are the answer matrices for each of the H experts, and each element of X^k is an integer denoted by x_{ij}^k. The diagonal elements of each answer matrix X^k are all set to 0. The $n \times n$ average matrix $\boldsymbol{A}$ for all expert opinions can be computed by averaging the scores of H experts as follows:

$$a_{ij} = \frac{1}{H}\sum_{k=1}^{H} x_{ij}^k \tag{1}$$

The average matrix A = [α_{ij}] is also called the initial direct relation matrix. A shows the initial direct effects that a factor exerts on and receives from other factors. In addition, the causal effect between each pair of factors can be mapped out in a system by drawing an influence map. Figure 3 below is an example of such an influence map. Here, each letter represents a factor in the system. An arrow from *c* to *d* shows the effect that c has on d, and the strength of its effect is 4. DEMATEL can convert the structural relations among the factors of a system into an intelligible map of the system.

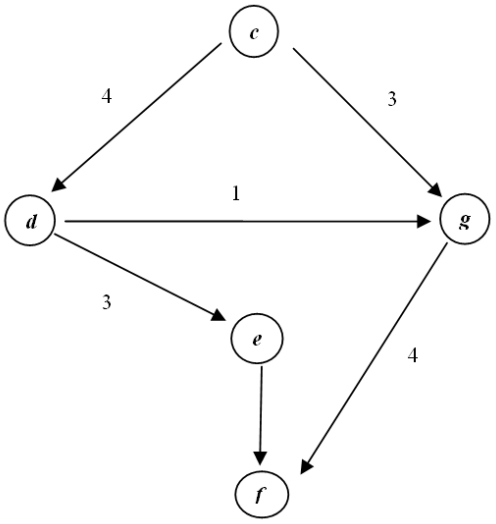

Figure 3. Example of an influence map.

Step 2: Calculate the normalized initial direct-relation matrix. The normalized initial direct-relation matrix $\boldsymbol{D}$ is obtained by normalizing the average matrix $\boldsymbol{A}$ in the following way:

$$\text{Let } s = \max\left(\max_{1\le i\le n}\sum_{j=1}^{n} a_{ij}, \max_{1\le j\le n}\sum_{i=1}^{n} a_{ij}\right) \tag{2}$$

Then

$$D = \frac{A}{s} \tag{3}$$

Given that the sum of each row j of matrix $\boldsymbol{A}$ represents the total direct effects that factor i on the other factors, $\max_{1\le i\le n}\sum_{j=1}^{n} a_{ij}$ represents the total direct effects of the factor with the most direct effects on

others. Similarly, considering that the sum of each column *i* of matrix ***A*** represents the total direct effects received by factor *i*, $\max_{1\le j\le n}\sum_{i=1}^{n} a_{ij}$ represents the total direct effects received of the factor that receives the most direct effects from others. The positive scalar *s* takes the lesser of the two values as the upper limit, and the matrix ***D*** is obtained by dividing each element of ***A*** by the scalar *s*. Each element d_{ij} of matrix ***D*** has a value of 0 or less than 1.

Step 3: Compute the total relation matrix. A continuous decrease of the indirect effects of problems along the powers of matrix ***D***, e.g., $\boldsymbol{D}^2, \boldsymbol{D}^3, ..., \boldsymbol{D}^\infty$, guarantees convergent solutions to the matrix inversion similar to an absorbing Markov chain matrix. $\lim_{m\to\infty} \boldsymbol{D}^m = [0]_{n\times n}$ and $\lim_{m\to\infty}(\boldsymbol{I}+\boldsymbol{D}+\boldsymbol{D}^2+\boldsymbol{D}^3+...+\boldsymbol{D}^m) = (\boldsymbol{I}-\boldsymbol{D})^{-1}$, where *0* is the $n \times n$ null matrix and *I* is the *n x n* identity matrix. The total relation matrix ***T*** is an $n \times n$ matrix and is defined as follows:

$$\boldsymbol{T} = [t_{ij}]\ i, j = 1, 2, \ldots, n$$

where

$$\begin{aligned} \boldsymbol{T} &= \boldsymbol{D} + \boldsymbol{D}^2 + \ldots + \boldsymbol{D}^{\boldsymbol{m}} = \boldsymbol{D} + \boldsymbol{D}^2 + ... + \boldsymbol{D}^{\mathrm{m}} = \boldsymbol{D}(I + \boldsymbol{D} + \boldsymbol{D}^{\boldsymbol{2}} + ... + \boldsymbol{D}^{m\text{-}1}) \\ &= \boldsymbol{D}[(I + \boldsymbol{D} + \boldsymbol{D}^{\boldsymbol{2}} + ... + \boldsymbol{D}^{m\text{-}1})(1\text{-}\boldsymbol{D})](1\text{-}\boldsymbol{D})^{\text{-}1} = \boldsymbol{D}(\boldsymbol{I}\text{-}\boldsymbol{D})^{-1}, \text{ as } m \to \infty \end{aligned} \quad (4)$$

In addition, ***r*** and ***c*** are defined as $n \times 1$ vectors representing the sum of rows and sum of columns of the total relation matrix ***T*** as follows:

$$\boldsymbol{r} = [r_i]_{n\times 1} = \left(\sum_{j=1}^{n} t_{ij}\right)_{n\times 1} \quad (5)$$

$$\boldsymbol{c} = [c_j]'_{1\times n} = \left(\sum_{i=1}^{n} t_{ij}\right)'_{1\times n} \quad (6)$$

where superscript $'$ denotes to transpose.

When r_i is the sum of the *i*th row in matrix ***T***, then r_i shows the total effects, both direct and indirect, given by factor *i* to the other factors. When c_j denotes the sum of the *j*th column in matrix ***T***, then c_j shows the total effects, both direct and indirect, received by factor *j* from the other factors. Thus, when *j* = *i*, the sum $(r_i + c_i)$ yields an index that represents the total effects both given and received by factor *i*. In other words, $(r_i + c_i)$ shows the degree of importance (total sum of effects given and received) that factor *i* plays in the system. In addition, the difference $(r_i - c_i)$ shows the net effect that factor *i* contributes to the system. When $(r_i - c_i)$ is positive, factor *i* is a net causer, and when $(r_i - c_i)$ is negative, factor *i* is a net receiver.

Teng suggested that between 5 and 15 expert questionnaires are needed [41], whereas Saaty and Vargas [42] postulated that 3 to 7 expert questionnaires are suitable, since expert questionnaires are used as an expert's judgment rather than statistical concepts [43]. Tzeng and Huang [44] consulted five experts and emphasized their experience. In the present study, six experts were selected from industrial, official, and academic institutions with professional knowledge and experience. Two experts are CSR managers from global airlines. Two experts are in charge of CSR programs in global airlines. One expert is a representative of the Taiwan Civil Aeronautics Administration. One expert is a scholar from the

Department of Air Transportation. The backgrounds of the expert team are shown in Table 2. The matrix of total relation is shown in Appendix. The influence of the degree of purchasing concern factors is shown in Table 3, and the causal diagram of total relationship is shown in Figure 4.

Table 2. Expert team backgrounds.

Background / Expert	Background	Male/Female	Professional Experience
Expert #1	Global airlines CSR manager	Male	Over 10 years' airline management experience, responsible for environment division and corporate safety office
Expert #2	Global airlines CSR project manager	Female	10 years' airline experience and now is executive secretary of airline's CSR committee
Expert #3	Taiwan civil aeronautics administration (CAA)	Male	Over 10 years' CAA experience, now responsible for environmental management
Expert #4	Global airlines CSR manager	Male	Over 10 years' airline management experience of environmental division
Expert #5	Professor of air transportation management department	Female	Over 20 journal article publications in airline operation and management field
Expert #6	Global airlines CSR project manager	Female	3 years' airline experience and over 5 years' CSR project management experience. Responsible for publishing CSR report for airlines.

5. Results and Discussion

First, we obtained the average matrix from six expert questionnaires using Equation (1). We then calculated the normalized initial direct-relation matrix based on average matrix by using Equations (2) and (3). Equation (4) was then used to compute the total relation matrix. The *r* value and c value of each criterion are then calculated using Equations (5) and (6). We then obtained the values of $r + c$ and $r - c$ of each criterion, which are presented in Table 2. By drawing the values of $r + c$ and $r - c$, we obtained the influence map, which is presented in Figure 4.

According to the results of the DEMATEL method, corporate governance (EC1) is the most critical criterion and the key criterion influencing all other criteria. The importance of corporate governance is manifested not only in CSR activities but also in strategies across enterprises. Corporate governance is the most critical criterion for CSR, and it can be inducted for the following reasons. First, CSR is a new concept in enterprises, and new concepts need support from top management. Second, CSR does not easily yield the apparent performance in the short term [3]. Third, CSR activities need many functions or department integration and coordination. Fourth, CSR is a high-level and long-term strategy for enterprises, and it influences many other strategies. The importance of firm value in governance and its relationships with CSR was also mentioned by Ammann and Schmid [45]. However, they outlined good corporate governance, which seemed to assure that CSR expenditures are profit-oriented rather than serving the personal ambitions of managers.

The second critical criterion is risk and crisis management (EC2). Risk management is a basic concept of CSR. The strong relationship between risk management and CSR has also been proven by Olson and

Wu [46] in a book review of *Innovative CSR: From Risk Management to Value Creation*. They mentioned CSR as a major issue in enterprise risk management from the societal and business perspectives. If an enterprise reduces risks to the lowest and simultaneously allows optimum opportunities, this enterprise will have the most sustainability. However, in the real world, risks and opportunities usually come at the same time. Thus, risk and crisis management is very important. In addition, risk management is the key effect criterion influenced by others. Risk management is influenced by the other 13 criteria, and several criteria did not directly influence risk management, including customer relationship management (EC5), operational eco-efficiency (EN5), labor practice indicators and human rights (SO2), human capital development (SO3), talent attraction and retention (SO4), and corporate citizenship and philanthropy (SO5). However, these criteria also influenced risk management, albeit indirectly. Only biofuel/alternative energy (EN2) and noise (EN3) are independent of the result; the reasons are discussed later in this paper.

Table 3. The degree of influence of airline CSR strategy.

Code	Criteria	*r*	*c*	*r* + *c*	*r* − *c*
EC1	Corporate Governance	2.89	2.40	5.29	0.49
EC2	Risk and Crisis Management	2.49	2.50	4.99	−0.01
EC3	Codes of Conduct/ Compliance/Corruption and Bribery	1.96	1.66	3.62	0.30
EC4	Antitrust Policy	1.70	1.41	3.11	0.29
EC5	Customer Relationship Management	1.68	2.12	3.8	−0.44
EC6	Brand Management	2.24	2.49	4.73	−0.25
EC7	Supply Chain Management	1.80	2.09	3.89	−0.29
EC8	Efficiency	2.06	2.51	4.57	−0.45
EC9	Fleet Management	1.92	2.16	4.08	−0.24
EC10	Reliability	2.11	2.29	4.4	−0.18
EN1	Climate Change	1.74	1.60	3.34	0.14
EN2	Biofuel/alternative energy	1.54	1.43	2.97	0.11
EN3	Noise	1.37	1.34	2.71	0.03
EN4	Environmental Policy/ Management System	1.88	1.86	3.74	0.02
EN5	Operational Eco-Efficiency	1.55	1.84	3.39	−0.29
SO1	Environment and Social Reporting (Information Disclose)	1.96	1.90	3.86	0.06
SO2	Labor Practice Indicators and Human Rights	1.75	1.53	3.28	0.22
SO3	Human Capital Development	1.92	1.65	3.57	0.27
SO4	Talent Attraction and Retention	1.94	1.77	3.71	0.17
SO5	Corporate Citizenship and Philanthropy	1.32	1.54	2.86	−0.22
SO6	Stakeholder Engagement	1.83	1.80	3.63	0.03
SO7	Product Responsibility (Safety)	2.24	2.00	4.24	0.24

The third critical criterion is brand management (EC6). Customers are influenced by many factors, such as cost and scheduled flight. However, brand image can be additionally attractive to customers and draw increased pricing power on the market. The fourth critical criterion is product responsibility (safety) (SO7). Safety is the most important concern of airlines and passengers. The IATA and ICAO have also placed many policies and audit focus on safety, such as the IATA operational safety audit (IOSA) program or the ICAO safety management system (SMS).

Biofuel/alternative energy (EN2) and noise (EN3) are independent, and they do not influence nor get influenced by the other criteria. For biofuel, many safety concerns have to be tested and verified. In terms of cost, fuel price is the greatest expense of airlines. Several airlines, such as Air France KLM [47], Lufthansa [48], Qantas [49], ANA [50], and Cathay Pacific [51], have invested in many projects and have joined biofuel alliances, such as the European Advanced Biofuel Flight Path 2020 initiative [52] to protect biofuel resources and reduce biofuel price. Noise influences local residents, and very limited resources can help reduce the noise. Current noise-reduction approaches that are used include electronic technologies, such as such as eTruck, and follow the "Balanced Approach to Aircraft Noise Management," which was reaffirmed by ICAO in 2007 to reduce airport operation noise [53]. These two criteria exhibit similar characteristics.

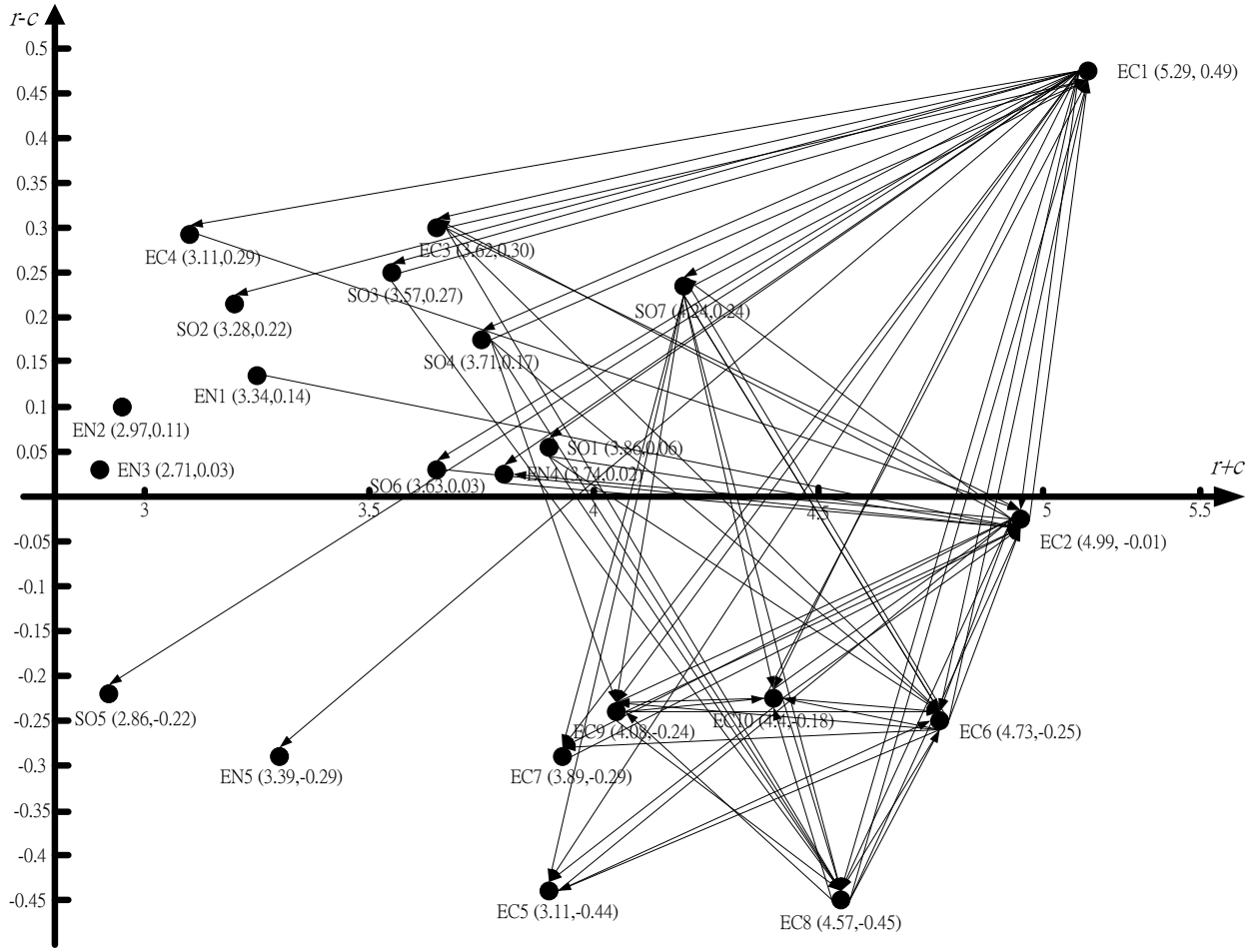

Figure 4. The influence map of total relationship.

To further verify the results, this research interviewed senior managers of global airlines. Five senior vice presidents and one vice president of Asian global airlines were interviewed for this study to obtain the real viewpoint of frontline managers as to how their CSR strategies affect their respective airlines. The key interview excerpts are shown in Table 3.

On the basis of the interviews, the key factors in CSR strategy are corporate governance, customer relationship management, brand management, efficiency, fleet management, climate change, biofuel/alternative energy, operational eco-efficiency, environment and social reporting (information disclosure), labor practice indicators and human rights, human capital development, talent attraction and retention, corporate citizenship and philanthropy, stakeholder engagement, and product responsibility (safety). The results show that the evolution hierarchy built in this research can cover all key factors of the CSR strategy of the airline industry.

The interview of the senior managers revealed that functional managers are driven by different motivations. However, the evaluation hierarchy built in this research increased the comprehensiveness of these considerations. The DEMATEL method discussed the relationship between each criterion and presented the visible influence map for easily realizing the interrelations of the different criteria. Moreover, comparison of the results proved that CSR strategy entails multiple decision-making processes. DEMATEL is suitable in building and analyzing a structural model involving causal relationships between complex factors.

In recent years, airlines have faced an extremely competitive and challenging environment. Fuel cost and low-cost carriers have forced airlines to rethink their business plans and adapt their long-term growth strategies [7]. The 2013 statistics of IATA show that global passenger market revenue passenger kilometer (RPK) has grown by 5.2% compared to 2012 figures; however, total supply volume also grew by 4.8%. The freight ton kilometer (FTK) of the ton market grew by 1.4% in 2013, but total supply volume (passenger plane belly cargo compartment) grew by 2.6%.

Consolidation continued throughout the industry to deal with this challenging environment, and new route-sharing partnerships helped create economies of scale and reduce operating costs. Wang [54] said that airlines can influence consumer purchase intention by enhancing the customer perception of brand equity and brand preference by joining a global airline alliance. However, product differentiation has become increasingly important because competition among airlines has led to the saturation of global airline alliances. According to Saeidi [55], an enhanced reputation and a competitive advantage are consequences of increased customer satisfaction after engaging in CSR. Thus, a clear CSR strategy is a good approach in constructing brand image [26].

Table 4. Key excerpts from the interview with the senior manager.

Senior manager	Interview key excerpts	Criterion comparison
Senior vice president 1	Airline customers and clients exhibit high regionality/locality, and CSR strategy must capture local customers	Customer Relationship Management
	The freight route must be influenced by oil price and cost, and fleet management should be considered along with CSR strategy	Fleet Management/Operational Eco-Efficiency
Senior vice president 2	CSR must be based on the health capital and pay attention to shareholder equity	Corporate Governance
	Cooperate governance transparency is the key factor of CSR	
	Environmental protection should be combined with financial performance	Corporate Governance/Efficiency
	Operational environmental activities should be based on reduced cost and increased revenue	Corporate Governance/Efficiency/Operational Eco-Efficiency
	Brand value comes from customer perception of the airlines, and the basic factors include safety, service quality, and intimacy	Brand Management/ Product Responsibility (Safety)/ Customer Relationship Management
	Abundant employee reward to encourage CSR activities in their daily work	Human Capital Development
Senior vice president 3	Bring up cross-function talents to allow CSR deepening in the company	Human Capital Development
	The core value of the company must reflect on the CSR strategy	Corporate Governance
	Trainings exhibit limitations, and CSR can help enhance employee loyalty and coherence	Talent Attraction and Retention
	In-flight products should exhibit the eco-design concept, such as low CO_2 emissions, recycling, and reusing	Climate Change/Operational Eco-Efficiency
	Communication and propaganda are very important, as when the Boeing company delivery flight gave clear information of design and manufacture with the sustainability concept of the flight	Stakeholder Engagement/Environment and Social Reporting (Information Disclosure)
Senior vice president 4	Improved public relation on the CSR approach for building up company image and public trust	Customer Relationship Management/Brand Management
	Concrete action, such as the plan for replacing a bus or vent by electric vehicle (EV)	Biofuel/Alternative energy
	Innovative environmental measure without cost, such as in reducing the temperature in the landed aircraft to save the energy consumption of air conditioners; the crew can ask the passengers to lower down the window shade before leaving the aircraft	Operational Eco-Efficiency

Table 4. *Cont.*

Senior manager	Interview key excerpts	Criterion comparison
Senior vice president 5	Fuel efficiency is the main financial and environmental factor among airlines; we can attempt finding the new flight along with prioritizing safety	Efficiency/Fleet Management/Product Responsibility (Safety)
	Finances, environment, and safety are the basis of airline CSR; thus, all innovative practices must include these three key factors	Corporate Governance/Product Responsibility (Safety)
	Biofuel is the main topic of airlines in the near future; CSR strategy cannot be ignored	Biofuel/Alternative energy
Vice president 1	CSR should not only focus on charity, but must also construct strategy for all dimensions to strengthen competitiveness	Corporate Citizenship and Philanthropy/Corporate Governance
	The employee is one of the key stakeholders; truly listening to employees will increase their commitment	Labor Practice Indicators and Human Rights
	CSR strategy needs clear KPIs for managers to ensure that every function is on the right track	Corporate Governance

6. Conclusions and Future Research

Although the airline industry plays an important role in the transportation and tourism sector, it also induces negative impacts, such as air pollutants, grave contributions to climate change, noise, and other economic and social issues. The pressure from the EU (European Commission Directorate-General for Climate Action [56]) to reduce the CO_2 emissions is proof that the airline industry and IATA are committed to achieving carbon-neutral growth by 2020. However, other issues such as economic and social concerns should also be addressed to enhance competitiveness. Therefore, airlines should start implementing comprehensive CSR strategies. However, some airlines, particularly those in Asia, are not establishing adequate CSR strategies.

This research constructed an evaluation model for airlines to examine the interrelationship among CSR issues and provide airlines with a clear vision for devising CSR strategies. For this purpose, an evaluation strategy that is comprehensive and suitable to the airline industry was built. By implementing the DEMATEL method with the expert insight from industrial, government and academic institutions, a clear influence map of total relationship was made. To obtain the viewpoint of an airline senior manager in regards to CSR strategy, five senior vice presidents and one vice president managing global airlines were consulted. The results of the DEMATEL method and senior managers' interview were compared.

Limitations and Further Research

This paper focused on identifying the CSR strategy of Asia-Pacific airlines; however, low-cost carriers (LCCs) were not considered. Nevertheless, the CSR strategies of both types of airlines are presumed similar, although the different operation models between global airlines and LCC may affect the key strategy factors.

For further research, the CSR strategies of rising LCCs in Asia-Pacific should be examined. As well, the results obtained in this research can be compared with the results of stakeholder engagement present in CSR reports of airlines to gain a more extensive discussion of CSR issues. Multiplicative methods applied in this field can also be studied.

Author Contributions

Dong-Shang Chang and Allen H. Hu designed the research; Sheng-Hung Chen and Chia-Wei Hsu performed the research; Dong-Shang Chang, Sheng-Hung Chen and Chia-Wei Hsu collected and analyzed data; Dong-Shang Chang, Sheng-Hung Chen, Chia-Wei Hsu and Allen H. Hu wrote the paper; finally, Chia-Wei Hsu revised the paper. All authors have read and approved the final manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

Appendix

Table A1. The matrix of total relation.

	EC1	EC2	EC3	EC4	EC5	EC6	EC7	EC8	EC9	EC10	EN1
EC1	0.1118	0.1708	0.1333	0.1211	0.1420	0.1644	0.1399	0.1709	0.1458	0.1580	0.1068
EC2	0.1452	0.1012	0.1158	0.0910	0.1286	0.1456	0.1213	0.1469	0.1357	0.1470	0.1067
EC3	0.1227	0.1225	0.0554	0.0928	0.1021	0.1132	0.1061	0.1168	0.0963	0.1100	0.0613
EC4	0.1096	0.1152	0.1004	0.0416	0.0816	0.1083	0.1011	0.1032	0.0782	0.0916	0.0522
EC5	0.1020	0.1077	0.0709	0.0582	0.0588	0.1254	0.0882	0.1019	0.0774	0.0900	0.0587
EC6	0.1296	0.1333	0.0919	0.0827	0.1352	0.0903	0.1272	0.1390	0.1143	0.1138	0.0814
EC7	0.1069	0.1163	0.0800	0.0727	0.0934	0.1037	0.0616	0.1098	0.0848	0.1068	0.0686
EC8	0.1226	0.1232	0.0774	0.0658	0.1111	0.1257	0.1063	0.0838	0.1210	0.1283	0.0752
EC9	0.1103	0.1200	0.0687	0.0522	0.0967	0.1163	0.0926	0.1323	0.0677	0.1202	0.0849
EC10	0.1278	0.1373	0.0823	0.0704	0.1255	0.1400	0.1056	0.1408	0.1229	0.0789	0.0763
EN1	0.0939	0.1123	0.0540	0.0504	0.0742	0.0934	0.0865	0.1030	0.0974	0.0977	0.0479
EN2	0.0853	0.0889	0.0418	0.0392	0.0609	0.0848	0.0763	0.0886	0.0871	0.0868	0.0915
EN3	0.0673	0.0791	0.0378	0.0326	0.0710	0.0818	0.0677	0.0819	0.0720	0.0744	0.0619
EN4	0.1039	0.1139	0.0571	0.0473	0.0874	0.1042	0.0962	0.1018	0.0925	0.0959	0.0966
EN5	0.0861	0.0867	0.0488	0.0373	0.0677	0.0884	0.0886	0.0924	0.0816	0.0816	0.0850
SO1	0.1061	0.1155	0.0831	0.0752	0.1008	0.1120	0.0967	0.1123	0.1013	0.1056	0.0781
SO2	0.1055	0.1042	0.0829	0.0632	0.0831	0.1017	0.0834	0.1111	0.0834	0.0900	0.0528
SO3	0.1176	0.1080	0.0897	0.0664	0.1004	0.1141	0.0832	0.1240	0.1100	0.1110	0.0637
SO4	0.1181	0.1087	0.0781	0.0606	0.0982	0.1178	0.0865	0.1219	0.1137	0.1116	0.0614
SO5	0.0787	0.0716	0.0487	0.0433	0.0828	0.0989	0.0632	0.0719	0.0582	0.0608	0.0460
SO6	0.1104	0.1161	0.0779	0.0703	0.0907	0.1099	0.0892	0.1075	0.0913	0.0953	0.0683
SO7	0.1388	0.1517	0.0861	0.0740	0.1303	0.1483	0.1253	0.1432	0.1245	0.1327	0.0801

Table A1. *Cont*.

	EN2	EN3	EN4	EN5	SO1	SO2	SO3	SO4	SO5	SO6	SO7
EC1	0.0957	0.0860	0.1272	0.1171	0.1391	0.1208	0.1265	0.1319	0.1165	0.1232	0.1445
EC2	0.0824	0.0845	0.1169	0.1040	0.1065	0.0981	0.0999	0.0989	0.0769	0.1055	0.1354
EC3	0.0556	0.0500	0.0694	0.0652	0.0934	0.0844	0.0912	0.1005	0.0670	0.0847	0.0980
EC4	0.0471	0.0449	0.0592	0.0577	0.0829	0.0657	0.0688	0.0718	0.0545	0.0773	0.0844
EC5	0.0537	0.0515	0.0684	0.0673	0.0791	0.0579	0.0642	0.0732	0.0666	0.0738	0.0829
EC6	0.0693	0.0692	0.0907	0.0866	0.1018	0.0836	0.0910	0.1010	0.0920	0.1045	0.1153
EC7	0.0606	0.0519	0.0846	0.0866	0.0860	0.0631	0.0635	0.0638	0.0659	0.0740	0.1018
EC8	0.0723	0.0606	0.0953	0.0915	0.0841	0.0760	0.0861	0.0957	0.0694	0.0932	0.0977
EC9	0.0824	0.0854	0.0930	0.0923	0.0737	0.0621	0.0717	0.0783	0.0567	0.0740	0.0901
EC10	0.0703	0.0644	0.0878	0.0865	0.0856	0.0742	0.0843	0.0884	0.0675	0.0828	0.1089
EN1	0.0917	0.0561	0.1062	0.1059	0.0837	0.0503	0.0505	0.0564	0.0704	0.0777	0.0836
EN2	0.0384	0.0606	0.0945	0.1032	0.0744	0.0419	0.0447	0.0503	0.0626	0.0627	0.0707
EN3	0.0551	0.0313	0.0852	0.0850	0.0661	0.0413	0.0409	0.0493	0.0554	0.0610	0.0682
EN4	0.0882	0.0943	0.0585	0.1099	0.0966	0.0566	0.0598	0.0660	0.0772	0.0875	0.0846
EN5	0.0747	0.0720	0.0886	0.0484	0.0749	0.0460	0.0546	0.0545	0.0572	0.0693	0.0684
SO1	0.0667	0.0702	0.0919	0.0881	0.0591	0.0756	0.0763	0.0771	0.0788	0.0872	0.0997
SO2	0.0447	0.0426	0.0662	0.0622	0.0841	0.0458	0.0955	0.1075	0.0775	0.0821	0.0843
SO3	0.0494	0.0470	0.0775	0.0823	0.0828	0.0922	0.0536	0.1089	0.0723	0.0837	0.0807
SO4	0.0528	0.0506	0.0782	0.0802	0.0862	0.0955	0.1086	0.0576	0.0758	0.0871	0.0870
SO5	0.0420	0.0436	0.0544	0.0538	0.0683	0.0522	0.0608	0.0663	0.0334	0.0696	0.0552
SO6	0.0599	0.0576	0.0758	0.0747	0.0864	0.0739	0.0804	0.0837	0.0730	0.0529	0.0810
SO7	0.0766	0.0676	0.0922	0.0936	0.1018	0.0744	0.0787	0.0885	0.0738	0.0867	0.0739

References

1. Chang, Y.C.; Yu, M.M.; Chen, P.C. Evaluating the performance of chinese airports. *J. Air Transp. Manag.* **2013**, *31*, 19–21.
2. Wang, Q.; Wu, C.; Sun, Y. Evaluating corporate social responsibility of airlines using entropy weight and grey relation analysis. *J. Air Transp. Manag.* **2015**, *42*, 55–62.
3. Lee, S.; Park, S.Y. Financial impacts of socially responsible activities on airline companies. *J. Hosp. Tour. Res.* **2010**, *34*, 185–203.
4. Chen, F.Y.; Chang, Y.H.; Lin, Y.H. Customer perceptions of airline social responsibility and its effect on loyalty. *J. Air Transp. Manag.* **2012**, *20*, 49–51.
5. Cowper-Smith, A.; de Grosbois, D. The adoption of corporate social responsibility practices in the airline industry. *J. Sustain. Tour.* **2011**, *19*, 59–77.
6. Searcy, C.; Elkhawas, D. Corporate sustainability ratings: An investigation into how corporations use the dow jones sustainability index. *J. Clean. Prod.* **2012**, *35*, 79–92.
7. RobecoSam. The sustainability yearbook 2015. Available online: http://yearbook.robecosam.com/files/rs_data/pdf/RobecoSAM_Sustainability_Yearbook_2015.pdf (accessed on 15 June 2015).
8. Global Reporting Initiative. Sustainability reporting guidelines g 3.1. Available online: https://www.globalreporting.org/resourcelibrary/G3.1-Guidelines-Incl-Technical-Protocol.pdf (accessed on 15 June 2015).
9. Global Reporting Initiative. Sustainability reporting guidelines g4. Available online: https://www.globalreporting.org/reporting/g4 (accessed on 15 June 2015).
10. International Air Transport Association (IATA). Available online: http://www.iata.org/about/Pages/index.aspx (accessed on 15 June 2015).
11. International Civil Aviation Organization (ICAO). Available online: http://www.icao.int/Pages/default.aspx (accessed on 15 June 2015).
12. Govindan, K.; Kannan, D.; Kannan, D. Evaluating the drivers of corporate social responsibility in the mining industry with multi-criteria approach: A multi-stakeholder perspective. *J. Clean. Prod.* **2014**, *84*, 214–232.
13. Hsu, C.C.; Liou, J.J.H. An outsourcing provider decision model for the airline industry. *J. Air Transp. Manag.* **2013**, *28*, 40–46.
14. Hsu, C.W.; Lee, W.H.; Chao, W.C. Materiality analysis model in sustainability reporting: A case study at lite-on technology corporation. *J. Clean Prod.* **2013**, *57*, 142–151.
15. Lin, R.J. Using fuzzy dematel to evaluate the green supply chain management practices. *J. Clean Prod.* **2013**, *40*, 32–39.
16. Ou Yang, Y.P.; Shieh, H.M.; Tzeng, G.H. A vikor technique based on dematel and anp for information security risk control assessment. *Inf. Sci.* **2013**, *232*, 482–500.
17. Liou, J.J.H. Developing an integrated model for the selection of strategic alliance partners in the airline industry. *Knowl.-Based Syst.* **2012**, *28*, 59–67.
18. Tsai, W.H.; Hsu, J.L. Corporate social responsibility programs choice and costs assessment in the airline industry—A hybrid model. *J. Air Transp. Manag.* **2008**, *14*, 188–196.
19. Liou, J.J.H.; Yen, L.; Tzeng, G.H. Building an effective safety management system for airlines. *J. Air Transp. Manag.* **2008**, *14*, 20–26.

20. Coles, T.; Fenclova, E.; Dinan, C. Tourism and corporate social responsibility: A critical review and research agenda. *Tour. Manag. Perspect.* **2013**, *6*, 122–141.
21. Amini, M.; Bienstock, C.C. Corporate sustainability: An integrative definition and framework to evaluate corporate practice and guide academic research. *J. Clean. Prod.* **2014**, *76*, 12–19.
22. Elkington, J. *Cannibals with Forks: Triple Bottom Line of 21st Century Business*; Capstone Publishing Ltd.: Mankato, MN, USA, 1998.
23. The World Business Council on Sustainable Development (WBCSD). *Corporate Social Responsibility: Meeting Changing Expectations*; WBCSD: Geneva, Switzerland, 1999.
24. Zhao, Z.Y.; Zhao, X.J.; Davidson, K.; Zuo, J. A corporate social responsibility indicator system for construction enterprises. *J. Clean Prod.* **2012**, *29–30*, 277–289.
25. Lynes, J.K.; Andrachuk, M. Motivations for corporate social and environmental responsibility: A case study of scandinavian airlines. *J. Int. Manag.* **2008**, *14*, 377–390.
26. Lee, S.; Seo, K.; Sharma, A. Corporate social responsibility and firm performance in the airline industry: The moderating role of oil prices. *Tour. Manag.* **2013**, *38*, 20–30.
27. Fenclova, E.; Coles, T. Charitable partnerships among travel and tourism businesses: Perspectives from low-fares airlines. *Int. J. Tour. Res.* **2011**, *13*, 337–354.
28. Mak, B.L.M.; Chan, W.W. A study of environmental reporting: International japanese airlines. *Asia Pac. J. Tour. Res.* **2007**, *12*, 303–312.
29. Mak, B.L.M.; Chan, W.W.H.; Wong, K.; Zheng, C. Comparative studies of standalone environmental reports—European and asian airlines. *Transp. Res. Part D Transp. Environ.* **2007**, *12*, 45–52.
30. Chang, D.S.; Kuo, L.C.R. The effects of sustainable development on firms' financial performance? An empirical approach. *Sustain. Dev.* **2008**, *16*, 365–380.
31. International Civil Aviation Organization (ICAO). 2013 environmental report. Available online: http://www.icao.int/environmental-protection/Pages/EnvReport13.aspx (accessed on 15 June 2015).
32. Carbon Disclosure Project (CDP). Climate change program. Available online: https://www.cdp.net/en-US/Programmes/Pages/CDP-Investors.aspx (accessed on 15 June 2015).
33. United Nations. Global compact. Available online: https://www.unglobalcompact.org/ (accessed on 15 June 2015).
34. International Labour Organization. Available online: https: www.ilo.org/ (accessed on 15 June 2015).
35. Wu, W.W.; Lee, Y.T. Developing global managers' competencies using the fuzzy dematel method. *Expert Syst. Appl.* **2007**, *32*, 499–507.
36. Chiu, Y.J.; Chen, H.C.; Tzeng, G.H.; Shyu, J.Z. Marketing strategy based on customer behaviour for the LCD-TV. *Int. J. Manag. Decis. Mak.* **2006**, *7*, 143–165.
37. Hori, S.; Shimizu, Y. Designing methods of human interface for supervisory control systems. *Control Eng. Pract.* **1999**, *7*, 1413–1419.
38. Hsu, C.W.; Kuo, T.C.; Chen, S.H.; Hu, A.H. Using dematel to develop a carbon management model of supplier selection in green supply chain management. *J. Clean Prod.* **2013**, *56*, 164–172.
39. Tsai, W.H.; Chou, W.C. Selecting management systems for sustainable development in smes: A novel hybrid model based on dematel, anp, and zogp. *Expert Syst. Appl.* **2009**, *36*, 1444–1458.
40. Tzeng, G.H.; Chiang, C.H.; Li, C.W. Evaluating intertwined effects in e-learning programs: A novel hybrid mcdm model based on factor analysis and dematel. *Expert Syst. Appl.* **2007**, *32*, 1028–1044.

41. Teng, J.Y. *Project Evaluation: Methods and Applications*; National Taiwan Ocean University: Keelung, Taiwan, 2002.
42. Saaty, T.L.; Vargas, L.G. *Decision Making in Economic, Political, Social, and Technological Environments with the Analytic Hierarchy Process*; RWS Publications: Pittsburgh, PA, USA. 1994.
43. Lee, C.C.; Chiang, C.; Chen, C.T. An evaluation model of e-service quality by applying hierarchical fuzzy TOPSIS method. *Int. J. Electron. Bus. Manag*. **2012**, *10*, 38–49.
44. Tzeng, G.-H.; Huang, C.-Y. Combined dematel technique with hybrid mcdm methods for creating the aspired intelligent global manufacturing and logistics systems. *Ann. Oper. Res.* **2012**, *197*, 159–190.
45. Ammann, M.; Oesch, D.; Schmid, M.M. Corporate governance and firm value: International evidence. *J. Empir. Financ.* **2011**, *18*, 36–55.
46. Olson, D.L.; Wu, D. Innovative csr: From risk management to value creation. *J. Clean. Prod.* **2010**, *18*, 1767–1768.
47. Air France KLM. 2013 CSR report. Avaliable online: http://www.airfranceklm.com/sites/default/files/publications/2013_radd-en.pdf (accessed on 15 June 2015).
48. Lufthansa group. 2013 sustainability report. Avaliable online: http://www.lufthansagroup.com/fileadmin/downloads/en/responsibility/balance-2014-epaper/ (accessed on 15 June 2015).
49. Qantas. 2013 Integrated ESG analysis. Avaliable online: http://www.qantas.com.au/infodetail/about/investors/qantas-sustainability-review-2013.pdf (accessed on 15 June 2015).
50. ANA Holdings. Annual report 2014. Avaliable online: http://www.anahd.co.jp/en/investors/data/pdf/annual/14/14_00.pdf (accessed on 15 June 2015).
51. Cathay Pacific. Sustainable development report 2013. Avaliable online: http://downloads.cathaypacific.com/cx/aboutus/sd/2013/index.html (accessed on 15 June 2015).
52. European Commission. European advanced biofuel flight path. Avaliable online: http://ec.europa.eu/energy/en/topics/biofuels/biofuels-aviation (accessed on 15 June 2015).
53. International Civil Aviation Organization (ICAO). Balanced approach to aircraft noise management. Avaliable online: http://www.icao.int/environmental-protection/Pages/noise.aspx (accessed on 15 June 2015).
54. Wang, S.W. Do global airline alliances influence the passenger's purchase decision? *J. Air Transp. Manag.* **2014**, *37*, 53–59.
55. Saeidi, S.P.; Sofian, S.; Saeidi, P.; Saeidi, S.P.; Saaeidi, S.A. How does corporate social responsibility contribute to firm financial performance? The mediating role of competitive advantage, reputation, and customer satisfaction. *J. Bus. Research* **2015**, *68*, 341–350.
56. European Commission. Directorate-general for climate action. Avaliable online: http://ec.europa.eu/clima/policies/transport/aviation/documentation_en.htm (accessed on 15 June 2015).