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Assessing the impact of environmental innovation in the airline industry: An empirical study of emerging market economies

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A B S T R A C T

The environmental impacts have been a growing concern in the airline industry around the world. However, few results have been derived to assess the impact of environmental innovation in the context of emerging market economies. Using secondary data manually collected from 40 airline companies from the emerging market economies, this study empirically examines the impact of environmental innovations on firms' financial performance and operational efficiency. We classify environmental innovations into technology-based and process-based innovations. We find that both technology- and process-based environmental innovations positively influence airlines' revenue, but only process-based environmental innovations have positive impacts on airlines' profit. In addition, our results support a negative interaction relationship between technology- and process-based environmental innovations on airlines' financial performance. In relation to operational efficiency, we find that only process-based environmental innovations exert a positive impact on the occupancy rate of airlines. As what is likely the first study addressing this issue in emerging economies, this paper fills an academic void by raising the issue and providing a grounded analysis. The results of this study have broad implications for both researchers and practitioners.

Keywords: Environmental innovation, Airline industry, Emerging market economies, Empirical study.

1. Introduction

Over the past decade, the impact of environmental innovations on different aspects of business has attracted increasing attention from both practitioners and researchers (Van den Bergh et al., 2011). In particular, the relationship between environmental innovations and a firm's profitability has been extensively studied in the literature (Angel del Brio and Junquera, 2003; Konar and Cohen, 2001; Lankoski, 2000; Porter and Van der Linde, 1995). However, mixed results have been found, and some arguments are not supported by empirical results (Brunnermeier and Cohen, 2003). For example, using a case study approach, Porter and Van der Linde (1995) argue that environmental innovations can stimulate long-term firm growth and competitiveness. By contrast, Lankoski (2000) argues that any causal effect of environmental performance on overall economic performance is likely to be small and thus difficult to detect. One reason for these mixed results is that the existing studies are focused on examining firm performance at an aggregate level, for example, based on firms' profit or

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revenue, and no study has extended its research to other dimensions, such as detailed process-level performance, including operational efficiency. In addition, the results of these studies are based on data collected from one or more industries in developed economies (for example, the manufacturing sector in the U.S.). Thus, these results are often either industry- or country-specific. These challenges provide opportunities for research examining other dimensions of performance or a new context.

In this study, we attempt to contribute to the environmental innovation literature by examining how environmental innovations influence airline companies' performance along two dimensions: aggregated-level performance, i.e., financial performance in terms of revenue and profits, and process-level performance, i.e., operational efficiency in usage capacity. We choose the airline industry in emerging market economies as our research context due to these economies' increasing practical and theoretical relevance.

From a practical perspective, in recent years, airlines in emerging market economies have gradually become important players in the global airline industry in terms of both revenue and the number of passengers.[1] With their rapid growth, the associated economic, social and environmental responsibilities are also increasing. As a result, airlines' environmental impact and responsibility in emerging market economies are attracting considerable attention and increasing their managerial relevance.

From a theoretical perspective, pressure from competitors (Scott, 1997) as well as strict government regulations (Brunnermeier and Cohen, 2003) are two forces that are driving companies to invest in environmental innovation initiatives. However, in contrast to those from developed economies, companies from emerging economies tend to have fewer resources and often prioritize initiatives that do not require a significant amount of investment but are capable of generating quick financial returns (Iyer et al., 2006). This situation makes environmental innovations less attractive for airline companies in emerging economies. In addition, the necessary organizational conditions and norms to foster environmental innovations are often lacking in emerging market economies (Iyer et al., 2006). The conflicting results from both sides render the airline industry in emerging economies a unique and interesting context for this study.

The empirical data used in this study are manually collected from multiple sources. In the first step of the analysis, we conducted semi-structured interviews with executives from an airline company in an emerging market country. From the interviews, we identified several industry-specific practices that relate to environmental innovations in the airline industry. These practices include biofuel use, winglet use, continuous descent approach, online check-in options, CO_2-offset programs, and charges for checked luggage. Next, we classified these practices into two categories: technology-based and process-based environmental innovations. The former focuses more on technological solutions that help to enhance environmental protection, whereas the latter primarily relates to innovations that occur in service processes that help to reduce an airline's environmental impact. Our results show that process-based environmental innovations have significantly positive effects on the airline companies' financial performance (as measured in terms of both profit and revenue) as well as their operational efficiency (as measured in terms of the average occupancy rate of the aircraft). By contrast, technology-based environmental innovations positively relate only to airline companies' revenue. In addition, we find a significantly negative interaction effect between technology- and process-based environmental innovations on airline companies' financial performance. Our results provide evidence that, even in the context of emerging economies, investing in environmental innovations can work out positively on the economic performance of firms. However, firms with a limited amount of resources may need to think carefully about their *strategies* with regard to environmental innovation: although each type of environmental innovation will have a positive effect on performance, simultaneously pursuing both types of environmental innovations could lead to competition for resources and result in a diminished economic performance.

The remainder of the paper is organized as follows. In Section 2, we provide an overview of the existing studies related to environmental innovations in the airline industry in emerging economies. In Section 3, we review the theoretical background, propose a typology for environmental innovation, and present our hypotheses. In Section 4, we summarize the data-collection process and the analytical methodology used in this study. In Section 5, we present the results. Finally, in Section 6, we conclude the paper and discuss the most important results.

2. Industry background: environmental innovations in emerging market economies

2.1. Environmental innovations in the global airline industry

The airline industry plays an increasingly important role in promoting global economic and cultural development (ICAO, 2010). As a result, the environmental impacts of the airline industry, which are primarily caused by its extensive emissions, are both alarming and important. According to the International Air Transport Association (IATA, 2013), the aviation industry produced 705 million tons of CO_2 in 2013, accounting for approximately 12% of CO_2 emissions from all transport sources and 2% of the global man-made carbon-dioxide emissions. The industry's share of global emissions is expected to increase to approximately 3% by 2050. Particularly in developed economies, pressure from regulators and the market has forced the airline industry to take further steps to develop new technologies, improve operational efficiency, and enhance scientific and managerial research in this field. For example, Lykotrafiti (2012) finds that in North America and Europe, more than 50,000

[1] https://www.iata.org/about/Documents/iata-annual-review-2013-en.pdf.

Table 1
Fleet size of some airlines from emerging market economies as of 2013.

Airlines	Fleet Size	Percentage in Emerging Markets
Emirates	218 (+272 orders)	4.7%
Turkish Airlines	289 (+169 orders)	6.3%
TAM	169 (+99 orders)	3.7%
Korean Air	161 (+131 orders)	3.5%
China Southern	503 (+36 orders)	10.9%
Air China	336 (+195 orders)	7.3%
China Eastern	403 (+195 orders)	8.8%
Hainan Airlines	142 (+62 orders)	3.1%

Source: Annual reports of the airlines.

flights have already used biofuels as a result of heavy investment in environmental innovation. Air-traffic management technologies are also undergoing a series of modernization processes, including the Single European Sky project in the EU and the NextGen program in the U.S.

2.2. *The airline industry and environmental innovations in emerging market economies*

The term *emerging market* or *economy* can be broadly defined as a country noted for its increasing stability, infrastructure, wealth and other positive features, although not to the same extent as markets in the developed world (Khanna and Palepu, 2010). Jagdish (2011) further identifies five key characteristics (market heterogeneity, sociopolitical governance, unbranded competition, inadequate infrastructure, and chronic shortage of resources) that distinguish emerging market economies from developed market economies.

Despite the lack of a standard definition, there are generally three aspects of a country's economy that are often used to determine whether it can be classified as an emerging market economy (Arnold and Quelch, 1998). The first characteristic is the country's absolute level of economic development, normally measured by the average GDP per capita, or the relative balance of industrial/commercial and agricultural activity. This aspect overlaps with other categorizations, such as developing countries or less-developed countries. The second aspect of a country's economy is its pace of economic growth, which is usually measured by the GDP growth rate. The third aspect is the system and structure of market governance as well as the degree of market freedom; if the country is in the process of economic liberalization from a planned economy, it is often referred to as a "transitional economy." In our study, "emerging market economy" refers to countries that satisfy any of these three criteria.

The airline industry in emerging economies plays an increasingly important role in the global aviation industry and to some extent constitutes the main opportunity for industry growth (IATA, 2012). Table 1 summarizes the fleet size of some representative airline companies in emerging economies. A growing market implies increasing responsibility. For example, with China having already overtaken the U.S. as the largest carbon emitter, Chinese airline companies have become increasingly alarmed by their negative environmental impacts; in addition, both social and governmental forces are pressuring these companies to take various measures to demonstrate their environmental awareness and commitment. Moreover, although not necessarily "innovation centers," many emerging market economies, particularly China and India, are becoming manufacturing centers that should have easier and likely cheaper access to new technologies that can improve operational efficiency and reduce emissions (Iyer et al., 2006). These two forces facilitate the creation and adoption of environmental innovations in emerging economies.

Nevertheless, airline companies in emerging economies often experience tight financial constraints and attract customers whose preferences are different from those in developed economies. For example, researchers have found that customers in emerging economies tend to value product and service features that are reduced to their essence (Petrick, 2011), which implies that in contrast to those from developed economies, companies from emerging market economies are confronted by intense competition not only in terms of product or service features but also in the ratio between the "real" value of these features and their costs (Iyer et al., 2006). In addition, developing the necessary institutional conditions, such as organizational culture and norms, is crucial for successful innovations in emerging market economies (Iyer et al., 2006). Consequently, airline companies in emerging market economies tend to pursue short-term financial returns rather than investing in initiatives with uncertain outcomes. In practice, projects resembling the Single European Sky project in the EU and the NextGen program in the U.S. are still lacking in emerging economies, and it remains unclear how environmental innovations can influence different aspects of airline performance.

3. Theoretical background and hypothesis building

3.1. *1 a taxonomy of environmental innovation*

In the existing literature, innovation is classified in different ways. For example, innovations can be classified as incremental (continuous) versus breakthrough (discontinuous) (Wind and Mahajan, 1997), depending on the level of novelty and the potential impact, or product versus process innovations, depending on the players along the value chain (Schumpeter, 1934). In the literature, environmental innovation is often treated as a special type of innovation that is distinguished from the others by its particular effects on the environment (Bernauer et al., 2007; Kemp and Pearson, 2007), regardless of whether these effects were the direct objective of the innovation (Bernauer et al., 2007). This distinction implies that conceptually, an innovation initiative with positive impacts on the environment may simultaneously fall into different categories, such as product innovation or incremental innovation. Consistent with the existing studies, we take a broad perspective on environmental innovation and define it as new ideas, solutions or processes that provide both customer and business value while decreasing environmental impacts.

In the extant literature on environmental innovation management, different approaches have been used to classify firms' environment-related innovation initiatives. For example, in an empirical study, Theyel (2000) defines and measures two types of environmental innovation practices. One is called "material substitution" and is measured based on whether a firm has modified its production processes by substituting the use of non-hazardous or less hazardous materials. The other is called "process change" and is measured based on whether a firm has developed or modified its production processes to reduce waste. In another study, Frondel et al. (2007) classify environmental innovations as "end-of-pipe" versus "cleaner production" environmental innovations, depending on the stage at which the innovation takes place. Most existing taxonomies of environmental innovations are derived from a manufacturing context, and there is no taxonomy specific to the airline industry. In this study, we consider the main area where the environmental impact takes place and classify the environmental innovation practices of airlines into two categories: technology-based and process-based innovations.

Technology- and process-based environmental innovations are different in several important respects. First, the main focus of technology-based environmental innovations is adopting novel and/or advanced technologies, whereas the focus of process-based environmental innovations is improving process efficiency in favor of a higher utilization ratio for the capacity, simpler procedures and/or the elimination of various sources of waste in the process (Benner and Tushman, 2003). Second, the adoption of technology-based environmental innovations does not necessarily require direct interaction with end customers. By contrast, despite the fact that process-based environmental innovation can occur within companies, its successful implementation often requires inputs from customers. For example, in the airline industry, any improvement in service procedures will require a significant amount of passenger input. Third, technology-based environmental innovations usually represent cutting edge and/or state-of-the-art technological advances (Chandy and Tellis, 1998), whereas process-based environmental innovations are not necessarily technologically advanced; instead, process-based environmental innovations often apply less sophisticated new technologies or simply introduce new ideas to business operations or procedures (Benner and Tushman, 2003; Christensen, 1997). Fourth, technology-based environmental innovations often require technological improvements or the redesigning of existing equipment and facilities. As a result, the initial investment to either buy new equipment or develop a new technology can be quite high, and sufficient returns may not be achieved within a short period. By contrast, process-based environmental innovations are often focused on changing a company's existing processes, which often requires less initial investment and a relatively short time to fully appreciate its returns (Adner, 2002).

3.2. *Motivations for environmental innovation adoption in the airline industry*

Companies adopt various types of innovations based on the belief that the innovations will enhance financial performance, which often refers to the tangible economic benefits that firms achieve in the short term (Christensen, 1997). The adoption decision can be triggered by both external and internal forces. Externally, firms could be pressured to adopt a particular innovation due to either the influence of competitors who have already adopted it (Scott, 1997) or pressure from government regulations, such as required pollution-abatement expenditures (Brunnermeier and Cohen, 2003). Internally, the likelihood of a firm fostering an initiative for a particular innovation can be influenced by several organization-specific characteristics, such as size (King and Lenox, 2000), norms, and organizational structure (Alberti et al., 2000). For example, environmental innovations are more likely to occur in standardized, well-structured organizations (Alberti et al., 2000).

3.3. *Hypotheses*

Adopting the perspective of stakeholder management theory, Freeman (1984) has argued that the responsibility of a firm is to satisfy not only its shareholders but also all relevant stakeholders. Currently, social responsibility is an important consideration in the decision making of firms (McWilliams and Siegel, 2001). Environmental innovations, among the critical factors comprising a firm's social responsibility, positively influence the brand image and reputation of a firm, which in turn could be translated into financial success (Peinado-Vara, 2006).

Technology-based environmental innovations provide better technological solutions and concepts than existing solutions do. They help reduce environmental impacts by either reducing energy consumption or improving the collection of hazardous waste (Frondel et al., 2007). Consequently, firms could achieve better financial performance by paying less for energy consumption and/or pollution abatement. Unlike technology-based environmental innovations, process-based environmental innovations focus on improving existing processes and may or may not create superior technological solutions. In the context of the airline industry, process-based environmental innovations can create new value for customers through convenient check-in procedures, reduced waiting times, etc., thus helping to attract new customers and maintain existing ones (Chandy and Tellis, 1998). In addition, a simplified passenger procedure can also help airline companies directly reduce their operational costs by using either less staff or less paper. Therefore, we expect a positive relationship between environmental innovations, including both technology- and process-based innovations, and the financial performance of an airline company.

However, environmental innovations can be costly. As Baylis et al. (1998) have shown, environmental innovation initiatives are often associated with increased investment in financial and human resources, which explains why large firms tend to be more likely than small firms to implement environmental innovations. The benefits generated by environmental innovations may not be able to justify their additional costs and may even damage the ability of a firm to invest in other initiatives to attract customers. In the airline industry, because of the presence of strong bandwagon pressures (Scott, 1997) from peer airlines and government regulatory requirements, adopting environmental innovations may not necessarily create the desired economic benefit (Brunnermeier and Cohen, 2003). In various contexts, prior studies have produced mixed findings regarding the relationship between environmental innovations and financial performance (Alvarez et al., 2001; Carter et al., 2000; Schnietz and Epstein, 2005). In one empirical study conducted in the Spanish hotel industry, for instance, Alvarez et al. (2001) find a positive relationship between environmental management practices and financial performance. However, others have argued for an inverse U-shaped (Angel del Brio and Junquera, 2003) or even non-significant relationship (Lankoski, 2000).

Given the mixed empirical findings in other contexts, we propose the following hypotheses predicting a positive relationship between environmental innovations and companies' financial performance. Note that given the mixed results in the existing literature, it is possible that environmental innovations may be negatively related to companies' financial performance. In that case, the following hypotheses can simply be reversed.

Hypothesis 1. Technology-based environmental innovations are positively related to the financial performance of airline companies in emerging market economies.

Hypothesis 2. Process-based environmental innovations are positively related to the financial performance of airline companies in emerging market economies.

Additionally, firms in emerging economies generally face tight budget constraints (Gunday et al., 2011). Investment in both technology-based and process-based environmental innovations will inevitably dilute the resources that would otherwise "focus" on a single type of innovation, thus diminishing the overall returns from both technology- and process-based environmental innovations. Empirically, Han et al. (1998) have found that small firms that pursue both explorative and exploitative innovations may have lower organizational growth and profitability than those that are "focused" and invest in only one type of innovation. In addition, airline companies in emerging economies are relatively smaller than their counterparts in developed economies. For example, except for a few Chinese airlines, the revenue of most airlines from emerging market economies is no higher than 20–30% of their counterparts in the U.S. or Europe. As a result, simultaneously pursuing both technology- and process-based environmental innovations will likely dilute their limited resources, blur their strategic focus and hurt their financial performance. Thus, we propose the following hypothesis regarding the interactive effect of the two types of environmental innovations:

Hypothesis 3. The interaction between technology-based and process-based environmental innovations is negatively related to the financial performance of airline companies in emerging market economies.

As discussed above, process-based environmental innovations are often related to the simplification of a procedure and offer new value to attract new customers and/or maintain existing customers. A higher passenger load factor will lead to greater operational efficiency in terms of increased utilization of the fleet of an airline company. Technology-based environmental innovations, on the other hand, can help increase airplane reliability and potentially reduce the frequency of maintenance and/or repairs, which in turn could translate into better "word-of-mouth" among passengers regarding their flight experience and help attract more passengers. In addition, improved financial performance due to reduced fuel consumption can enable airline companies to enjoy additional resources and to offer promotional initiatives, such as price discounts and loyalty programs, so as to achieve a good passenger load factor. Therefore, we propose the following hypotheses regarding the relationship between environmental innovations and the operational efficiency of an airline company:

Hypothesis 4. Technology-based environmental innovations are positively related to the operational efficiency of airline companies in emerging market economies.

Hypothesis 5. Process-based environmental innovations are positively related to the operational efficiency of airline companies in emerging market economies.

4. Data collection and measurement

4.1. Indicator identification and data collection

The existing literature has applied different approaches to measure the environmental innovations of a firm. One approach is the use of environment-related patents as a proxy for environmental innovation activities (Scott, 1997; Brunnermeier and

Cohen, 2003). However, as the authors using this approach note, patent data provide information regarding the industry that originates the patent, but not the industry of ultimate use. In addition, the economic significance of a higher number of patents is unclear in the sense that some patents may be worth more and may make a greater economic contribution than others (Brunnermeier and Cohen, 2003). In our study, we consider both technology-based and process-based environmental innovations. Technology-based environmental innovations adopted by the airline industry are patentable but are usually not "invented" by the airline industry. By contrast, process-based environmental innovations could be "invented" by the airline industry but are often not patentable. As a result, using patent data in our study would make it vulnerable to the risk of not really capturing the airline companies' "true" efforts to adopt environmental innovations.

Another approach involves the use of surveys that directly ask firms what environmental innovations have been used. For example, Theyel (2000) has conducted surveys with plant managers and asks for responses to two questions. One yes/no question pertains to whether a firm modified its production processes by substituting the use of non-hazardous or less hazardous materials over the past three years. The second yes/no question pertains to whether a firm developed or modified its production processes to reduce the amount of waste generated over the past three years. The survey approach has the strength of generating rich information directly from the sample firms. However, we did not use this approach in our study due to three considerations. First, as one type of primary data, survey data could be vulnerable to the risk of common method bias as well as the self-reporting bias of the person who fills out the questionnaire. As a result, the validity of the empirical results based on surveys often requires additional justification. Second, there are numerous existing studies in the literature that use survey data. However, few studies in the literature on environmental innovation management use non-patent secondary data. Therefore, collecting secondary data will be more valuable to the extant literature. Third, from a practical perspective, conducting a large-scale survey among multiple airline companies from dozens of countries requires extensive communication and coordination with sample firms and is not quite feasible for this study.

In this study, we adopted a third approach and collected publically accessible secondary data that are specific to the environmental innovation practices adopted by each sample airline.

To identify variables that are relevant to environmental innovations in the specific research context, we conducted several semi-structured interviews with two senior executives from Hainan Airlines (China) as the first step of our analysis. The sample questionnaire is provided in Appendix A. This step was crucial for our study because the airline industry in emerging economies is an under-investigated research area with little existing literature to build on. Therefore, identifying new indicators to reflect the environmental innovation practices of airline companies is necessary. At the end of the interviews, our interviewees helped us identify six environmental practices that are relevant for the airline industry: use of biofuels, use of winglets, continuous descent approaches, participation in CO_2-offset programs, online check-in, and charges for checked luggage. We briefly explain each identified practice below.

4.1.1. Biofuels

This type of fuel is produced from renewable biological resources, such as plant or animal materials, instead of from traditional fossil fuels (i.e., coal, oil and natural gas). Despite the fact that they may also create potentially detrimental environmental effects, biofuels can lead to a significant reduction in CO_2 emissions throughout their lifecycles, thus enabling the industry to reduce its carbon footprint by cutting its greenhouse-gas emissions.

4.1.2. Winglets

Winglets are angled extensions added to the end of some aircraft wings that help improve fuel efficiency by reducing the drag caused by airflow patterns over the wingtip.

4.1.3. Continuous descent approaches

This type of approach applies a new technology that results in a much smoother descent from the cruising level to the ground compared with the traditional stair-step approach. This technology can simplify stepping procedures and simultaneously reduce both fuel use and noise. In fact, airlines estimate that, on average, each continuous descent approach can save approximately 150 kg of jet fuel and 500 kg of CO_2 (ATAG, 2012).

4.1.4. CO_2-offset programs

These programs allow airline passengers to calculate the CO_2 emissions created during their flights and encourages them to compensate for and neutralize the environmental impact—normally through monetary means, such as donations.

4.1.5. Online check-in

This service, which is offered by most airlines, allows passengers to confirm their presence on a flight via the Internet or a mobile device and to print their boarding passes without having to wait in line at the airport. This service saves passengers time, enhances airline efficiency, and reduces the use of paper.

4.1.6. Charges for checked luggage

An increasing number of airlines impose charges for checked luggage. This policy, though understandably negative from the perspective of passengers, can save airlines a considerable amount of fuel and thus reduce their environmental impact (IATA, 2012).

Table 2
Technology-based innovations adopted by the airlines and measurement.

Technology-based innovations	Measurement
Use of biofuels	Percentage of flights using biofuels
Use of winglets	Percentage of aircraft with winglets
Continuous descent approach	Percentage of flights using this approach

In addition, we manually collected data about the financial performance of airline companies, average occupancy rates, and implementation of the six environmental innovation activities identified above. Unfortunately, no existing database provides sufficient information. Consequently, we conducted a broad search for publicly available information on environmental innovations in the airline industry in emerging economies. Information from multiple sources was combined to create our dataset. These sources include corporate annual reports, corporate social responsibility reports, and reports published by the International Air Transport Association (IATA), the International Civil Aviation Organization (ICAO), and the Air Transport Action Group (ATAG). Approximately 5000 pages of hardcopy documents and web pages were carefully studied to derive the required data.

We examined 61 airline companies from emerging economy countries. Forty companies had complete data and were included in our study. These airlines have headquarters located in the following countries: Argentina, Brazil, Chile, China, Colombia, Egypt, Hungary, India, Indonesia, South Korea, Malaysia, Mexico, Morocco, Pakistan, Philippines, Poland, Qatar, Romania, Russia, Saudi Arabia, South Africa, Sri Lanka, Thailand, Turkey, the United Arab Emirates, and Vietnam. The geographic coverage of the airlines is relatively complete because most of the representative airlines in virtually all of the countries classified as emerging economies were included in our sample. Overall, the sample airlines in our data account for approximately 30% of all passengers in the global airline industry. The airline data were collected as of 2012.

4.2. *Description of measures and variables*

4.2.1. *Dependent variables*

The dependent variables in this study are the financial performance and operational efficiency of airline companies. We measure an airline company's financial performance using two variables: (1) revenue and (2) profit. Revenue captures a firm's gross financial performance before deducting costs. By contrast, profit is a parameter that captures a firm's net financial performance after striking a balance between costs and benefits.

The second dependent variable, operational efficiency, is a process-level performance matrix and is measured using the average occupation rate of the fleet in the same year.

4.2.2. *Explanatory variables*

The two key explanatory variables in our study are technology- and process-based environmental innovations. Six indicators were identified in the interviews as reflective of the overall involvement of an airline company in environmental innovation activities. Consistent with the typology of environmental innovations proposed above, we classify three indicators as technology-based environmental innovations and three other indicators as process-based environmental innovations. The three indicators corresponding to technology-based environmental innovations are biofuel use, winglet use, and the continuous descent approach. We measure the application of each practice by calculating the percentage of aircraft in which the practice is implemented. There are two approaches available in the literature to generate an aggregated construct with multiple indicators. One approach is explorative factor analysis (EFA) and another is the equal weighting approach which eventually takes the average of all indicators. The overarching goal of the EFA approach is to identify the underlying relationships between measured variables. Usually, EFA is applied when there is no a priori hypothesis about factors or patterns of measured variables (Hair et al., 1998). The main strength of EFA is that the "weight" allocated to each variable is directly derived from the data and fits the existing data quite well. Its main weakness is that due to its excellent fit with a specific dataset, it will potentially maximize the association between the hypothetical underlying concept and the constructed scale in the sample. As a result, the "weight" derived from EFA tends to flatten sampling variability (Treiman, 2009; page 250) and this could constrain the generalizability of the findings based on it (Hair et al., 1998). By contrast, the equal weighting approach is to simply average all indicators without considering each variable's data-specific "weight" (Treiman, 2009). An equal weighting approach was applied to reflect an equal status for all indicators, when there are no clear empirical grounds for choosing a different scheme (Nardo and Saisana, 2008), such as the case of our study. The strength of this approach is that it is less vulnerable to the cross-sample shrinkage in terms of variable correlation (Treiman, 2009; Furr, 2011). The findings based on this approach could therefore be more reliable and potentially have a higher level of generalizability. Its weakness is that the construct aggregated in this way may not have the perfect "fit" with the existing data as the weight assigned to each indicator is pre-determined to be equal.

In this study, we report the main findings based on the equal weighting approach and show the results based on the EFA approach as a robustness check in Section 5.3. Table 2 summarizes the indicators that we use to measure technology-based environmental innovations as well as their measurements.

Table 3
Process-based innovations adopted by the airlines and measurement.

Process-based innovations	Measurement
CO_2 offset program	dummy variable (1 or 0)
Online check-in	dummy variable (1 or 0)
Charge for checked-in luggage	dummy variable (1 or 0)

Table 4
Descriptive statistics of variables.

Variables	Average	Standard Deviation
Revenue[a]	3.40	2.34
Aircraft Occupation Rate[b]	73.30	6.30
Use of biofuels[b]	2.22	3.34
Use of winglets[b]	41	16.70
Continuous descent approach[b]	51	50.60
CO_2 offset program[c]	0.67	0.47
Online check-in[c]	0.93	0.27
Fleet Age[d]	8.33	2.90
Fleet Size	121.2	101
Number of Employees	16,780	16,310
Number of Destinations	98	54

[a] Billion US dollars.
[b] Percentage.
[c] 1 or 0.
[d] Year.

For process-based environmental innovations, we use a dummy variable to measure the application of each practice. Ideally, we would use percentages to measure the practices related with process-based environmental innovations. Unfortunately, data regarding the percentage of these practices within a same airline are incomplete. For this reason we use dummy variables by assigning 1 to airlines that use a specific practice regardless of the percentage of its usage, and assigning 0 to airlines that do not use a specific practice at all. Table 3 summarizes these indicators as well as the measurement of each indicator. However, in our dataset, which includes 40 airline companies in emerging economies, only one company charged a fee for checked luggage. This finding implies that "charges for checked luggage," as one of the three indicators of process-based environmental innovation, do not vary much in the data; therefore, this indicator is not suitable to explain changes in the financial performance and/or operational efficiency of airline companies. Therefore, we dropped this indicator and retained the other two indicators to measure process-based environmental innovations. As with the approach used for technology-based environmental innovations, the average of the two remaining indicators (CO_2-offset programs and online check-in) is calculated to generate the index of the process-based environmental innovations adopted by airline companies.

4.2.3. Control variables

We have also included *fleet age* as a control variable. Fleet age is included because the fuel consumption of an aircraft is directly related to its age and the model of its engine; newer aircraft and engines are significantly more fuel-efficient. Fleet age is measured by the average age (in years) of the entire operating fleet of an airline.

Additionally, we control for *airline size* (e.g., Scholtens (2008)) using the fleet size, i.e., the number of aircraft an airline owns. As a robustness check, we considered an alternative measurement by using the number of employees. The results remain consistent with those based on fleet size and are available upon request.

We also controlled for the potential impact of *competition*. Within one market/country, the competition itself does not create variances in performance across airline companies because it is an external factor that is common to all players. In the airline industry, the competition among airlines actually occurs at the very micro-level of the route between two destinations. An airline that does not have many "major" competitors in a country/market may have strong competitors on only certain particular routes. As a result, creating a direct measurement of the competition in the airline industry is quite demanding, and we unfortunately lack detailed route-level information. Therefore, we took a different approach and measured competition indirectly by counting the *number of destinations* to which an airline flies. Clearly, an airline that operates between more destinations tends to have more competitors. Therefore, the number of destinations can be used as a proxy for the intensity of competition that an airline faces.

Table 4 summarizes the descriptive statistics for all of the variables that we used in this study.

Table 5
Regressions Results of Environmental Innovations on Airlines' Financial Performance (Revenue and profit, t-statistics in parentheses).

	Log Revenue Coeff.	Net Profit Coeff.
Technology-based	1.88** (2.42)	1143.58 (1.21)
Process-based	0.51*** (3.24)	288.52* (1.51)
Technology-based × Process-based	−0.99** (−2.31)	−804.3* (−1.53)
Fleet Age	0.003 (0.02)	33.81* (1.83)
Fleet Size	0.001 (1.14)	0.44 (0.59)
# of Destinations	0.002** (2.39)	2.88** (2.14)
Constant	2.20*** (7.25)	286.02 (0.77)
N	40	40
R-squared	0.619	0.407
p-value	0.000	0.052

* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

5. Analysis and results

5.1. Empirical models

We conducted multiple regressions using Stata to test the hypotheses. As explained earlier, the two dependent variables are the financial performance of the airlines, measured by annual profit/revenue, and their operational efficiency, measured by the aircraft occupancy rate. We applied a linear regression model to test the relationship between environmental innovations and profit/revenue. Because the annual profit/revenue of airline companies is considerably large compared with all of the other variables, we took the natural log of revenue when we ran the regression. This approach is quite common in quantitative data analyses (Treiman, 2009).

The other dependent variable, the average occupancy rate of the airline company, is a fractional variable ranging between 0 and 1. As a result, using an OLS model may risk generating predicted variables that go beyond the interval between 0 and 1. In practice, an OLS model works well when most of the data are between 0.2 and 0.8. Alternatively, some studies suggest treating the proportion as a binary response and then using a generalized linear model with a logit link to guarantee that the predicted values lie within the unit interval (Papke and Wooldridge, 1996). This approach generally works well if the proportion can be considered as the number of successes in the total number of attempts. The third approach is to treat the proportion as a censored continuous variable by assuming that data below 0 or above 1 are not observable (Long, 1997). This approach works best if there is not an excessive amount of censoring (values of 0 and 1). In empirical research, this approach (Tobit model) is more suitable for latent variables. In our study, however, the measurement of airline's operational efficiency is through the fixed average occupancy rate and is no longer latent. Consequently, Tobit model is not appropriate here. Therefore, we applied OLS and logit models in this study. It turns out that the results are quite robust. In the following, we present the results derived from the two models.

5.2. Main results

Table 5 shows the results for how technology- and process-based environmental innovations influence firms' profits/revenues.

Our results show that both technology- and process-based environmental innovations have significantly positive effects on airlines' revenue in emerging economies. However, only process-based environmental innovations are positively related to the airlines' profit. Thus, Hypothesis 2 is fully supported, and Hypothesis 1 is supported only for revenue, but not for profit. This result provides evidence that, even in a context with relatively tight budget constraints and an organizational culture that tends to favor short-term returns, investment in environmental innovations can create positive revenues. However, engaging in technology-based environmental innovations does not necessarily lead to an increased profit. One plausible explanation for this mixed result concerning technology-based environmental innovations is that the returns from technology-based environmental innovations require a longer time to be achieved, and in the short term the additional cost associated with such innovations may surpass the increased revenue.

However, if we further compare the coefficients of the effect of technology- and process-based environmental innovations on revenue, we find that technology-based environmental innovations have a greater positive effect than do process-based environmental innovations. This finding implies that technology-based environmental innovations, despite taking a longer time to achieve returns than process-based innovations, could generate greater returns.

In addition, our study shows a significantly negative interaction effect between the two types of environmental innovations in terms of their impact on both revenue and profit. This finding supports Hypothesis 3. The results imply that although both types of environmental innovations may lead to positive effects on firms' revenue, pursuing high levels of both technology-based and process-based environmental innovations will result in competition for limited resources, which

Table 6
Regressions Results of Environmental Innovations on Airline's Average Occupancy Rate (t-statistics in parentheses).

	Model 1 (OLS) Coeff.	Model 2 (Logit) Coeff.
Technology-based	0.14	0.75
Process-based	0.02**	0.06**
Fleet Age	0.001	−0.001
Fleet Size	−0.001	−0.001
# of Destinations	0.002	0.001
Constant	0.63***	0.54***
N	40	40
R-squared	0.412	
p-value	0.002	
Log Likelihood		64.58

** Significant at the 5% level.
*** Significant at the 1% level.

Table 7
Exploratory Factor Analysis.

Construct	Item	Loading Factor[a]	Cronbach α
Technology-based environmental innovation	Use of biofuel	0.612	0.75
	Use of winglets	0.353	
	Continuous descent approach	0.744	
Process-based environmental innovation	CO_2 offset program	0.354	0.71
	Online check-in	0.354	

[a] Extraction method: Principal component analysis. Rotation method: Varimax with Kaiser normalization.

could diminish the positive effect of any single type of environmental innovation. The overall interaction effect is therefore negative.

Our interviews with executives at Hainan Airlines provided some anecdotal background concerning this result. During the first half of 2011, Hainan Airlines launched its online check-in system in China's domestic market. "A lot of adjustments must be made. In particular, we need to ensure the security of online transactions," one executive stated. Due to the surge of oil price in the second half of 2011, Hainan Airlines started to test the usage of biofuels on some routes. As a result, "many people simply got confused... we lost our focus and did not know our priority." By the end of 2011, Hainan Airlines' profit had decreased nearly 13% compared with 2010.

Table 6 summarizes the results for the impact of environmental innovations on the operational efficiency of airline companies. As shown in Table 6, in both models, technology-based environmental innovations show no statistically significant impact on the average occupancy rate, but process-based environmental innovations have a significantly positive effect. Therefore, Hypothesis 5 is supported, and Hypothesis 4 is rejected. The mixed findings regarding the impact of environmental innovations on operational efficiency imply that, although customers in emerging economies can easily appreciate innovations related to the service process, which usually involves direct interaction with customers, they may not be aware of the technological improvements on their flights. In addition, this result implies that airline companies may not yet have transformed their savings from reduced fuel consumption into reduced ticket prices, leading to a greater passenger load factor. The exact impact of environmental innovations on airlines' pricing decisions remains unclear in our study and requires in-depth follow-up studies in the future.

5.3. Robustness check

In this section, we conduct exploratory factor analysis (EFA) to determine the weight allocated to each environmental-related practice and further evaluate construct validity. In the EFA, we include the information with respect to all practices related with environmental innovations, and the results show that the items can be comfortably tapped into the stipulated constructs: technology-based environmental innovation and process-based environmental innovation. As shown in Table 7, all retained factor loadings are above the commonly accepted threshold 0.3, so all constructs satisfy the unidimensionality requirement (Hair et al., 1998). We further examine construct reliability by measuring Cronbach's alpha, in which a construct is considered reliable if the value is greater than 0.6 (Nunnally, 1978). Our Cronbach's alpha results, ranging between 0.7 and 0.8, indicate that this criterion is met.

The above loading factors via EFA are then transformed into the "weight" assigned to each specific environmental innovation practice. In particular, the technology-based environmental innovation is measured as:

$$0.31 \times \text{use of biofuel} + 0.14 \times \text{use of winglets} + 0.55 * \text{continuous descent approach}$$

Table 8
Regressions Results of Environmental Innovations on Airlines' Financial Performance based on EFA (Revenue and Profit, t-statistics in parentheses).

	Log Revenue Coeff.	Net Profit Coeff.
Technology-based	1.57** (2.14)	1207.23 (1.35)
Process-based	0.58*** (2.84)	296.68* (1.19)
Technology-based × Process-based	−1.48* (−1.85)	−1570.1 (−1.61)
Fleet Age	0.001 (0.06)	40.32* (2.13)
Fleet Size	0.001 (1.02)	0.33 (0.44)
# of Destinations	0.003** (2.25)	2.93** (2.17)
Constant	2.55*** (10.81)	169.29 (0.59)
N	40	40
R-squared	0.613	0.354
p-value	0.000	0.002

* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

Table 9
Regressions Results of Environmental Innovations on Airlines' Average Occupancy Rate based on EFA (t-statistics in parentheses).

	Model 1 (OLS) Coeff.	Model 2 (Logit) Coeff.
Technology-based	0.14	0.73
Process-based	0.03*	0.12*
Fleet Age	0.001	−0.008
Fleet Size	−0.001	−0.001
# of Destinations	0.002	0.001
Constant	0.68***	0.76***
N	40	40
R-squared	0.443	
p-value	0.001	
Log Likelihood		65.82

* Significant at the 10% level.
*** Significant at the 1% level.

And the process-based environmental innovation is measured as:

$$0.5 \times CO_2 \text{ offset program} + 0.5 \times \text{ Online checkin}$$

Using the new measurements derived from EFA, we run regressions following the same steps as Tables 5 and 6. The results are summarized in Tables 8 and 9. They provide evidence in favor of our results being robust.

5.4. Post hoc analysis

We have found that both technology- and process-based environmental innovations have positive effects on airline revenue, but only process-based environmental innovations have positive effects on airline profit. In addition, our results support a positive relationship between process-based environmental innovations and the operational efficiency of airline companies. In this section, we conduct a more detailed *post hoc* analysis. The purpose of this additional analytical step is to obtain better knowledge regarding which specific environmental innovation practices (use of biofuels, use of winglets, continuous descent approaches, CO_2-offset programs, online check-in) have positive effects on the financial performance of an airline and/or the operational efficiency of their aircraft. The procedures and methodology remain the same as in Section 5.2. In addition to five environmental innovation practices considered in our main results, we also include the six (3 times 2) interactive terms in our *post hoc* regression analysis. The detailed results are summarized in Appendix A Tables A1 and A2. Because of multicollinearity, some interactive terms are automatically dropped in the regression. Here, we briefly explain the results from the *post hoc* analysis.

First of all, among the three technology-based environmental innovation practices, only the continuous descent approach presents a significantly positive relationship with airline revenue at 10% level ($p = 0.087$), but not with profits. One benefit of the continuous descent approach is the possibility of reducing the time required for landing, which in turn reduces aircraft turnover time, provides airline companies with more flexibility and enables them to schedule more flights in a given period of time. As a result, the airline company's revenue will increase. Our results of the *post hoc* analysis provide anecdotal evidence supporting this argument.

Another benefit of the continuous descent approach, often mentioned in the literature, is to help airline companies reduce their fuel consumption, and reduced operating costs in turn will lead to higher profits. However, our results do not support this argument. One potential explanation is that the cost savings from the continuous descent approach are not large enough to create a significant impact on airlines' profitability.

Regarding the relationship between process-based innovations and airlines' financial performance, our results show that only the CO_2-offset program is positively related to airlines' revenue and profits, and the relationship is statistically significant. Although online check-in also shows a positive relationship with profits, it lacks statistical significance, which again may be explained by the relatively small amount of cost savings from reduced check-in staff and boarding pass printing. Investment in CO_2-offset programs on the one hand generate additional costs to the balance sheets of airline companies and on the other hand could be viewed as an expenditure on marketing. Thus far, in emerging market economies, CO_2-offset programs are novel practices that are offered by only a limited number of airlines, although they have gained attention among stakeholders, especially those who are more environmentally conscious in their decision making, such as passengers who are conscious about their environmental impact and government officials. A detailed examination of the Social Responsibility Reports released by the sample firms shows that nearly 70% of the sample airlines (27 out of 40) reported a positive market perception to the companies' involvement in CO_2 reduction programs. As a result, offering a CO_2-offset program could send a clear signal to the market about an airline's willingness to take social responsibility, thus differentiating it from the rest of the market and attracting a proportion of the high-margin environmentally conscious customers who are willing to pay more for services with equal quality. This in turn provides additional incentives for airline companies to invest in CO_2-offset programs.

With respect to the interactive effect between technology-based and process-based environmental innovations, our results show that the interaction between use of winglets and CO_2 offset programs presents a significantly negative effect on firms' revenue and profit. One plausible explanation of this finding is that adding winglets to the aircraft and participating in CO_2 offset programs both require significant amounts of investment from the airlines. As a result, at least in short term, pursuing both practices simultaneously could disperse a firm's resources and weaken its ability to excel in either dimension. An in-depth study examining its impact on a firm's long-term performance merits future research.

With respect to the average occupancy rate of airline companies, our results show that across both models, only CO_2-offset programs has a significantly positive impact on aircraft's average occupancy. As explained previously, CO_2-offset programs could be a strategic initiative for market differentiation that can help attract more environmentally conscious passengers and thus enhance an airline's passenger load factor.

6. Conclusion and discussions

6.1. Summary of findings

Using data manually collected from multiple sources, this paper empirically examines the impact of environmental innovations on firms' financial performance and operational efficiency in the context of the airline industry in emerging economies. In this study, we classified environmental innovations into two categories: technology-based environmental innovations and process-based environmental innovations. We found that both technology- and process-based environmental innovations positively influence airlines' revenue, but only process-based environmental innovations have positive impacts on airlines' profit. In addition, our results supported a negative interaction relationship between technology- and process-based environmental innovations on airlines' financial performance. In relation to operational efficiency, we found that only process-based environmental innovations exert a positive impact on aircraft occupancy rate of the airlines. As what is likely the first study addressing this issue in emerging economies, this paper provides empirically based analyses through a novel perspective and approach. The results of this study may have implications for both researchers and practitioners.

6.2. Implications for research

For researchers, this study proposes a typology that categorizes environmental innovations into technology- and process-based initiatives and applies this typology to six industry-specific environmental innovation practices identified in the airline industry in emerging economies.

This study also contributes new findings to the extant literature on environmental innovation. The airline industry in emerging economies is a research context in which the creation and adoption of environmental innovations are likely to be hindered by tight budget constraints and cost-sensitive customers. Prior research suggests that, in such contexts, innovations requiring a longer horizon to achieve returns, such as environmental innovations, are unlikely to improve the financial performance of a firm (Iyer et al., 2006). In contrast to prior research, our results provide fairly clear evidence that, even in such a context, environmental innovations do help improve firm performance. However, our study highlights that the choice of performance metrics matters. For example, although environmental innovations, regardless of their type, seem to positively influence firms' revenue, they do not have the same effect on profit and operational efficiency.

Our results also show that the overall effect of pursuing both technology- and process-based innovations is negative. Adopting a resource-based view of the organization, firms must consume a significant amount of resources when developing environmental innovations (King and Lenox, 2000). On the one hand, investing in multiple types of environmental innovation initiatives may create an opportunity for "synergy"; on the other hand, doing so risks competition among initiatives for resources and blurs the "focus" of the overall innovation strategy of the firm.

6.3. Implications for practice

Our study also provides some suggestions for airline companies regarding their choice of environmental innovation initiatives. Our results show that process-based environmental innovations are positively related to both financial performance and operational efficiency of airline companies. Technology-based environmental innovations, despite lacking positive impact on operational efficiency and profit, are positively related to revenue, and their marginal impact on revenue is stronger than process-based environmental innovations. This finding is encouraging for airline companies, especially those in emerging economies.

Our *post hoc* analysis provides anecdotal evidence that, among the six common environmental innovation practices, continuous descent approach can positively affect airlines' revenue, while CO_2-offset programs can positively influence airlines' financial performance and operational efficiency. Charges for checked luggage do not have a significant effect on either financial performance or aircraft occupancy rate. However, this result is not conclusive because very few sample companies in our study have adopted this practice. Thus, the non-significant results may be driven by some random noise due to the small sample size. More research is needed in the future to examine the exact impact of the "charges for checked luggage" practice.

6.4. Limitations and directions for future research

Our study is subject to several limitations, which in turn offer opportunities for future research. First, our results must be considered in light of the nature of the research sample and data. Given the difficulty of collecting publically available data, the number of airline companies in our dataset is relatively small, though the vast majority of airlines in emerging economies are included. This limitation concerns the issue of the generalizability of our findings to developed markets, where firms usually have fewer budget constraints and customers who are not as cost-sensitive as those from emerging economies. Therefore, a detailed comparison between the results derived from emerging market economies and those from developed economies is necessary to deepen the understanding of the exact impact of environmental innovations on companies' performance at different levels. In addition, the results could also be examined for other industries where the pressure from competition and government regulations is not as strong as in the airline industry.

Another limitation of this study concerns the performance metrics for airline companies. Environmental innovations often take ample time and require costly investments in R&D (Van den Bergh et al., 2011). In this study, due to the lack of corresponding data, we used short-term performance metrics, namely, annual profits/revenues and the average occupancy rate of aircraft, instead of long-term performance metrics. However, some environmental innovation practices, such as the use of biofuels and winglets, may not generate immediate returns because they are related to technological breakthroughs, which often require a long cycle before benefits appear. As an agenda for future research, the long-term effects of environmental innovation practices as well as the evolution of these practices should be examined in detail. Moreover, there may be other aspects of performance metrics that firms could consider applying. For instance, future studies could examine how environmental innovation, in its different forms, influences service quality and customer satisfaction.

A third limitation of this study is the use of dummy variables in measuring the process-based innovations. Strictly speaking, these dummy variables make no differentiation among airlines that have distinct percentages of application for a specific practice. This limitation is due to the unavailability of relevant data. An improved, more detailed analysis of process-based environmental innovation can be undertaken as soon as new data become available.

We believe that a better and deeper understanding of the interaction between environmental innovations and firms' performance is crucial to advancing future research in the environmental innovation management literature. Our study finds a significantly negative interaction effect when companies pursue both simultaneously. However, companies are sometimes forced by their stakeholders to do so. In that case, what should be done? Finding a balance between different types of environmental innovations in terms of investment and outcomes could be a relevant area for future research in this and other related industries.

Appendix A.

Appendix B. : Guided Questionnaire

The interviews were semi-structured: the questions ensure that an initially identified set of issues is addressed. However, the questions are only a rough guide and leave room for emerging issues to surface.

- How do you evaluate the importance of reducing environmental impact in your company?
- What initiatives have been taken by your company in the past decade to reduce environmental impact? Please describe.
- How would you evaluate the performance of these initiatives? Did they help reduce environmental impact? Please describe.

Table A1
Post-hoc analysis The Impact of environmental innovation practices on airlines' financial performance (t-statistics in parentheses)

	Log Revenue Coeff.	Net Profit Coeff.
Use of Biofuels	1.40 (0.87)	2901.62 (1.33)
Use of Winglets	−0.28 (−0.16)	1562.22 (0.58)
Continuous Descent Approach	0.05* (0.16)	354.74 (0.84)
CO_2 Offset Program	1.15*** (3.84)	681.55* (1.68)
Online Check-In	−0.42 (−0.77)	284.02 (0.36)
Biofuel × CO_2 Offset	0 (omitted)	0 (omitted)
Biofuel × Online Check	0 (omitted)	0 (omitted)
Winglets × CO_2 Offset	−2.76** (−2.68)	−2389.87* (1.72)
Winglets × Online Check-in	1.82 (1.32)	657.88 (0.35)
Continuous Descent × CO_2 Offset	0.07 (0.2)	298.08 (0.66)
Continuous Descent × Online Check	0 (omitted)	0 (omitted)
Fleet Age	−0.01 (−0.53)	−59.51* (−2.65)
Fleet Size	0.001 (1.00)	0.467 (0.57)
# of Destinations	0.002* (1.71)	3.08* (2.05)
Constant	2.87*** (3.97)	895.17 (0.91)
N	40	40
R-squared	0.6577	0.408
p-value	0.0001	0.005

* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

Table A2
Post-hoc analysis: The impact of environmental innovation practices on airlines' average occupancy rate (OLS and generalized linear model with logit link, t-statistics in parentheses).

	Model 1 (OLS) Coeff.	Model 2 (Logit) Coeff.
Use of Biofuels	1.19 (3.78)	6.89 (3.65)
Use of Winglets	0.02 (0.37)	0.13 (0.47)
Continuous Descent Approach	0.04 (2.00)	0.19 (1.78)
CO_2 Offset Program	0.004* (0.19)	0.03* (0.25)
Online Check-in	0.005 (0.14)	0.02 (0.11)
Fleet Age	−0.003 (−1.04)	−0.02 (−0.96)
Fleet Size	−0.000 (−0.41)	−0.000 (−0.25)
# of Destinations	0.000 (.30)	0.001 (0.23)
Constant	0.72***	0.91** (3.10)
N	40	40
R-squared	0.522	
p-value	0.001	
Log Likelihood		73.53

* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

– Could you briefly describe each initiative you mentioned above? How does each initiative function in practice? Why do you think it helps to reduce environmental impact?
– What was the trigger for deciding whether an initiative should be implemented?

How do you evaluate the initiatives taken by your competitors to reduce environmental impact? Are they similar to what your company did?

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