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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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### ABSTRACT

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.

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## 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.<sup>1</sup> 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<sub>2</sub>-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<sub>2</sub> in 2013, accounting for approximately 12% of CO<sub>2</sub> 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

<sup>1</sup> <https://www.iata.org/about/Documents/iata-annual-review-2013-en.pdf>.

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