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A combined MCDM model based on DEMATEL and ANP for the selection of airline service quality improvement criteria: A study based on the Taiwanese airline industry

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ABSTRACT

The aim of this study is to select airline service quality improvement criteria for the Taiwanese airline industry. Numerous factors such as low railway prices, the development of high-speed rail, increases in petroleum prices, increases in foreign airline competition, and the recent economic depression have led many airlines in Taiwan to encounter financial difficulties and even closure. Researchers have begun to identify critical service quality improvement criteria with the goal of increasing the competitive advantages of airlines. Most of the selected criteria, however, suffer from a major technical problem: all of the measurement dimensions are independent, leading to inadequate criteria for measuring service quality. Our calculations consider the interrelationships and effects among the evaluation dimensions and criteria to precisely rank and select criteria. The value of this study is that it provides airlines with a direction for measuring and improving their service quality with the goal of developing sustained competitive advantage over the long term.

1. Introduction

In light of Taiwan's demographics and geographical structure as an island, its interactions and global trade depend largely on marine transit and airlift activities (Civil Aeronautics Administration [CAA], 2009). However, airlift activities are much more important in determining efficiency than marine transit activities, and efficiency in these activities is necessary to improve the Taiwanese economy and its international relationships. With the current domestic and international pressures stemming from, for example, low railway prices, the development of high-speed rail, increases in petroleum prices, increases in foreign airline competition, and the recent economic depression, an increasing number of airlines are facing financial difficulties due to a deficit and low market share, and some airlines failed to survive beyond late 2008. To resolve these difficulties, an increasing number of airlines have focused on improving their service quality to provide customers with a comfortable and safe experience while transporting them to their destinations on time (Wu et al., 2012).

In this study, we do not consider low-cost carriers such as Ryanair. Based on O'Connell and Williams's (2005) research findings, passengers who travel on low-cost carriers pay great attention to price and arrange their itineraries to take advantage of the least expensive airfares. Thus, they do not focus on other factors when they book their travel, and the brand reputations of low fare airlines have been embedded into their minds (O'Connell and Williams, 2005). O'Connell and Williams also find that passengers who use full service airlines do pay attention to price but tolerate higher airfare to acquire the advantages of the additional products and/or services provided by such airlines (O'Connell and Williams, 2005). In short, the market segment of low-cost carriers is customers who do not pay attention to service quality but to price, while the market segment of full service carriers primarily pays attention to service quality over price. Therefore, it would not be appropriate to incorporate low-cost carriers in this study, as we aim to provide a direction for airlines that use service quality as part of their strategy for developing sustained competitive advantages in the long term by helping them to measure and improve their service quality. Low-cost carriers are therefore beyond the scope of this study.

Although a stream of studies has developed numerous related models accompanied by various evaluation indices, the study of such indices has been predicated on a major technical problem; the

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evaluation dimensions are independent from one another (Huang et al., 2007; Liou et al., 2007; Tzeng et al., 2007), which makes the criteria for measuring service quality inadequate and lacking coherence. Specifically, as each organization has limited available resources, when an organization and/or company attempts to improve its operating performance (e.g., service quality), it would tend to invest its available resources in aspects that rank as more important than others without considering the effects of interrelations between factors (Chen and Chen, 2013). Empirical studies regarding service improvement in different industries have highlighted the interrelationships between focal evaluation indices (e.g., Hsieh et al., 2008). Therefore, in the selection of precise criteria in this study, our calculations consider the interrelationships and effects between the evaluation dimensions and criteria.

According to the official report of the Civil Aeronautics Administration (CAA) in Taiwan, there are three main dimensions that airlines use to plan for future development: safety, service, and satisfaction (the "3Ss"). In reviewing the current research, it is easy to find studies on each topic: safety (Liou et al., 2007), service (Chen and Wu, 2009; Liou and Tzeng, 2007, 2007; Lu and Ling, 2008, 2008; Sim et al., 2006, 2006; Tiernan et al., 2008), and satisfaction (Gkritza et al., 2006, 2006; López-Bonilla and López-Bonilla, 2008, 2008; Lu and Ling, 2008, 2008). However, research on the integration of these dimensions is still lacking. In accordance with Chen and Chen's latest research on airlines (Chen and Chen, 2010a,b), and in addition to the three above-mentioned dimensions, a new critical dimension has been created that involves the management of each of the three dimensions and contains three criteria. Therefore, to comprehensively construct a framework for airline service quality improvement for later evaluation and criteria selection, this study adopts four airline-focused measurement dimensions and criteria.

The purpose of this study is to select airline service improvement criteria to measure and improve airline service quality by resolving the above-mentioned technical problems using a combined multi-criteria decision-making (MCDM) model based on a decision-making trial and evaluation laboratory (DEMATEL) and an analytic network process (ANP) as proposed by Yang et al. (2008). The DEMATEL method is used to develop the interrelations among the evaluation dimensions to form an impact relations map (IRM). The DEMATEL was originally developed to solve issues regarding structural relationships in complex systems (Liou et al., 2007; Wu, 2008). Existing studies have identified several benefits of applying the DEMATEL in research. For example, Lin and Wu (2008) claimed that the DEMATEL is the most useful approach in causal analysis to facilitate the separation of the studied criteria of a system into cause and effect groups, thereby helping practitioners (e.g., decision makers) to determine the criteria with the greatest impact. Lin et al. (2011) claimed that the DEMATEL can be extended to solve causal relationship issues for core competences for an industry or company.

An ANP is usually conducted to loosen the restrictions of hierarchical structures (Yang et al., 2008) and was originally proposed by Saaty (1996). The ANP is used to address the hierarchical representation of relationships by taking the dependency of the factors (e.g., criteria and/or indices) into account while calculating the data (Yüksel and Dagdeviren, 2007). Many decision-related problems are difficult to structure hierarchically because they involve interaction and dependence between higher- (e.g., dimensions and/or criteria) and lower-level elements (e.g., criteria and/or indices). The ANP replaces hierarchies with networks and emphasizes the interdependent relationships among various decision criteria, therefore allowing for a more systematic analysis (Franek and Kresta, 2013). The current research demonstrates the advantages and reliability of each method (Lin and Wu, 2008; Momoh and Zhu, 2003). In this study, the DEMATEL is adopted to determine causal relationships and different impacts among service improvement dimensions. The IRM of the service improvement dimensions, which is developed through the DEMATEL, becomes a network evaluation structure for an ANP analysis, which is then used to calculate the relative weights of the service improvement criteria.

The remainder of this study is organized as follows. Service quality in the airline industry is discussed in Section 2. A combined MCDM model is proposed in Section 3. An empirical study is conducted in Section 4. A discussion on the application of our results to practice is presented in Section 5. A conclusion is presented in the final section.

2. Service quality in the airline industry

2.1. Quality definition

The traditional definition of quality is the degree of conformance to a specific standard (Venkatraman, 2007). However, due to its invisible nature and its application by different organizations, the definition of quality is dynamic and varies over time (Chen and Chen, 2010a,b; Shieh and Wu, 2002).

In the current research, quality is largely accepted as provider performance that exceeds the expectations of receivers (Sallis, 1993). Emphasizing the service industry, a growing body of organizations has started to delegate increasing effort and resources to improve and enhance their service quality because both practitioners and researchers have found that higher service quality can bring service-oriented organizations a higher market share, a greater return on investment (ROI), a reduction in operating costs, and an improvement in productivity (Chen and Chen, 2010a,b; Garvin, 1983).

2.2. Airline service quality

Service quality refers to consumers' subjective impressions regarding the efficiency and effectiveness of the service delivery process as provided by a service provider (Chen and Chang, 2005; Park et al., 2004). While service quality has been studied widely in the literature, its attributes are still open for further discussion and typically depend on the context targeted by the researcher (Liou and Tzeng, 2007). Therefore, finding ways to properly measure service quality has been a difficult issue for both researchers and industrial practitioners, including the airline industry (Gursoy et al., 2005; Park et al., 2004).

Empirical studies claim that service quality is generally the key to improving operational performance and competitive advantage as well as to generating profits and market share (e.g., Caruana, 2002; Cronin and Taylor, 1992; McDougall and Levesque, 2000; Parasuraman et al., 1994; Teas, 1994; Wilkins et al., 2007). In terms of the airline industry, related studies argue that providing outstanding service quality may influence airlines' long-term development (e.g., improved market share; Morash and Ozment, 1994; Zeithaml et al., 1996), sustained competitive advantage (e.g., Chen, 2008), and even survival (e.g., Park et al., 2006). Airline service quality may be viewed as a driver of passenger satisfaction, loyalty, and airline selection (Park et al., 2006). Mustafa et al. (2005) indicate that one of the most crucial factors in maintaining an airline's operations is the improvement of service quality for its passengers. In light of the above, the delivery of outstanding service quality becomes a critical marketing requirement for most, if not all, airline companies, as competitive pressures in the airline industry continue to increase (Andotra and Gupta, 2008; Ostrowski et al., 1993).