



Contents lists available at ScienceDirect

Applied Soft Computing

journal homepage: [www.elsevier.com/locate/asoc](http://www.elsevier.com/locate/asoc)

# Using a hybrid method to evaluate service innovation in the hotel industry

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## ARTICLE INFO

### Article history:

Received 21 December 2012

Received in revised form 26 August 2014

Accepted 30 November 2014

Available online xxx

### Keywords:

Choquet integral

Triangular fuzzy numbers

Quantitative scales

Qualitative scales

Service innovation

TODIM

Q5 Prospect theory

## ABSTRACT

This study develops a hybrid method to improve selection decision making in service innovation. Because criteria for customer perceptions tend to be vague and conflicting, the process of evaluating perceptions (qualitative scale) and operational data (quantitative scale) should be combined. This study proposes the concomitant evaluation of qualitative and quantitative scales using a hybrid approach that combines fuzzy set theory, a discrete multi-criteria method based on prospect theory (known as TODIM in Portuguese) and the non-addictive Choquet integral. The study assumes that the criteria possess inter-dependent relationships. The advantages of the proposed hybrid approach, which exhibits a hierarchical structure, have been demonstrated throughout the hot spring hotel industry. The proposed method demonstrates that it can be extremely useful for recommending operational alternatives because it clearly identifies the main criteria of the expressed alternatives. The results indicate that the approach easily and effectively accommodates criteria with gain and loss functions and can help practitioners improve their performance and reduce overall service innovation risks.

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## 1. Introduction

Q6 Due to significant growth during the 21st century, globalization of the service industry requires distinct assessments of value, service level and scalability features to guarantee sustainable growth for the hotel industry while simultaneously achieving a certain level of service quality. The traditional hotel industry faces a similar challenge of developing and promoting more responsive, cost-competitive and customer-focused services that continuously improve their business processes [1–4]. Hotels have historically focused on their resources, constraints and policies when making decisions and reducing costs. Due to intense competition and decreasing profit margins, this approach is no longer sufficient and current business practices are becoming increasingly interconnected. Service innovation and its associated dynamic capabilities are key concerns and key drivers of consistent high performance over time [5,6]. Some hotels now focus on improving customer service to achieve competitive advantages [7–10]. Service innovation provides assessments of service performance, service problems, and service delivery; such assessments serve as a basis for employee and corporate rewards. Service innovation also helps firms improve their service capabilities during the design stages to upgrade their service quality. Hence, service innovation is an important issue for improving their competitiveness in competitive markets [11].

Zhou et al. [12] suggested that products with a higher degree of innovation tend to achieve higher sales and financial performance, which ultimately leads to greater overall business performance. In contrast, Berry et al. [13] indicated that service firms can also achieve greater business performance through less innovative services. Based on this perspective, different types of service innovations should be studied in greater detail to determine how they affect market orientation and performance. The contribution of market orientation to new product/service performance has been examined by a number of empirical studies [12,14,15]. For instance, some researchers have verified a direct contribution of innovation to business performance [16,17], whereas other researchers have found no evidence in support of innovation for performance improvement [18–20]. Some studies have demonstrated innovation as a mediated effect on market orientation to new product/service performance [9,21]. That is, market-oriented service firms are inclined to produce or service innovation first, which leads to new service levels. Hence, the service innovation has to involve criteria from various hotels that collaborate to identify the correct way to design and implement the new service [22]. However, empirical studies remain equivocal regarding service sectors, and there is limited numerical support of service innovation in the literature.

Service providers are expected to assess the innovation of products or services. Service innovation criteria are usually presented in qualitative measures. Because the criteria tend to be subjective, qualitative, or described with linguistic information, they are encumbered with subjective perceptions. Thus, it is extremely difficult for decision makers to express their preferences using exact numerical values [20,23] (Zhang et al., 2010). Nevertheless, a firm must satisfy service innovation criteria under the constraint of subjective human preferences (uncertainty); however, this phenomenon has not been thoroughly examined. Regarding service innovation and fuzzy sets, Chien and Tsai [24] employed the Hamming distance and the possibility model to evaluate service quality, which do not consider information

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aggregation in the assumption of equal importance of criteria [25]. Chang and Yeh [26] used fuzzy multi-criteria to evaluate perceived service quality in airline firms. The traditional TODIM is incapable of solving a multi-hierarchical decision-making structure (Gomes et al., 2009) [27,28]. This study incorporates service innovation and TODIM into the generalized Choquet integral, which differs from previous studies on service innovation. This study compensates for the shortcomings of TODIM, which include the inability to address hierarchical relationships in proposed aspects, criteria and alternatives. Service innovation is an important source of competitive advantage and is expected to remain an important component of future business strategies. How can managers select and justify operational criteria among vague and subjective criteria that are subject to uncertainty?

Current studies offer several evaluation approaches for service provider selection based on service innovation criteria. Most studies assess service innovation based on its alignment with the objectives of the identified firm and fulfillment of a set of assessment criteria. An evaluation of the criteria is usually highly subjective and unstructured because it relies significantly on a manager's experience, knowledge, and intuition. However, managers cannot consider all relevant criteria due to their limited rationality and capacity for information processing [29–31]. Hence, the evaluation approach is often ineffectively implemented because managers do not effectively use their knowledge and experience with a previous service provider selection as an input to the prioritization of service innovation. As a result, managers are not confident that service provider selection is being studied and applied to a set of criteria that maximizes their firm's service innovation benefits. How can managers apply their knowledge of previous (successful and unsuccessful) service providers to support future decision making (i.e., to improve the quality of decisions)?

To effectively and empirically advance theory, more attention must be directed toward employing multi-criteria evaluations, assessing the validity of criteria and modifying unacceptable criteria through extensive literature reviews. Numerous criteria have been integrated that can be used to evaluate service innovation [1,2,9,10,21]. Firms can benefit from the development of reliable and valid criteria, and practitioners can apply these criteria as benchmarks to ensure continuous improvement. However, managers always encounter uncertainties in the evaluation and selection process. Many studies have argued that the service quality process is consumer-oriented and innovation-based. MCDM tools can be applied to address uncertainties in the service provider selection process [29,31–34]. MCDM allows managers to modify decision-making patterns in response to significant events in business environments. This study proposes a hybrid approach to capture the uncertainties in a complex decision-making environment through service innovation analysis with gain and loss functions. Although this proposed approach has not been addressed in previous studies, it is useful for storing a firm's strategic information and provides facilities for quantifying qualitative features in future decision-making processes.

The objective of this study is to create a mechanism that can aid managers in analyzing and selecting service providers for service innovation. The proposed mechanism allows managers to make decisions in a more systematic, clear and comprehensive manner; it also enable them to consider a more diversified set of main criteria that critically influence their choices and recommendations. To demonstrate the effectiveness of the proposed hybrid multi-criteria analysis for facilitating the service innovation process, an evaluation of the hot spring hotel industry is conducted in which service innovation criteria, which are critical to the success of hot spring hotels, are frequently applied. Although the fuzzy integral measurement model does not assume independence of each alternative, nonlinear situations are assumed to be independent.

This study is structured with three main sessions. First, the fundamentals of fuzzy set theory, TODIM, and the Choquet integral are introduced because the traditional TODIM does not address the hierarchical structure. Second, the proposed hybrid method is presented. This study presents a detailed development of service provider selection of service innovation in the hot spring hotel industry using the fuzzy TODIM-Choquet integral; the results are explained. Last, the feasibility of this approach is analyzed and discussed, and plans for further work are outlined.

## 2. Literature

This session presents a multiple-criteria decision support approach that develops a ranking and best-choice recommendation from a set of alternatives. Service innovation, MCDM and proposed evaluation criteria are discussed.

### 2.1. Service innovation

Service innovation is a concept for improving service that is taken into practice. A service innovation always includes replicable criteria that can be identified and systematically reproduced in industry. The replicable criteria can be the service outcome or the service process. It benefits both the service producer and the

customers, improves its developer's competitive edge and is based on some technology or systematic method [35].

Service innovation is increasingly considered a set of criteria for a firm's competitive strategy [9,15,31]. Its primary objective is to assist firms with improving their service capabilities during the design stages of service criteria development. Berry et al. [13] examined an innovation model that requires firms to innovate on two distinct service innovation fronts: (1) innovation in how service is delivered and (2) innovation of new offerings that satisfy the core benefits sought by service customers. Tsiotsou [36] discovered the evidence of a service innovation as a mediating contribution and implied that market orientation cannot directly impact a firm's performance without service innovation. Day (1994) indicated that developing capabilities is a bricolage in service innovation and competitive advantage and argued that value is created through service innovation as perceived by the service provider. The capabilities-based view suggests that a firm can achieve a competitive advantage through the distinctive capabilities of the firm. However, an evaluation of the capabilities-based view is always based on both qualitative and quantitative scales.

Zetenyi [37] suggested that the mean value of fuzzy numbers is a more appropriate representation of fuzzy numbers for human understanding and that the process of the proposed generalization incorporates the concept of service quality. Fuzzy numbers are one of the methods used to study uncertainty and are superior in the theoretical analysis of system with imprecise information and incomplete samples. Service quality is measured to assess service performance, to diagnose service problems, and to manage service delivery (Parasuraman et al., 1995). Moreover, firms must expand their existing services and service capabilities to address the fundamental needs of their customers. Firms must focus on service innovation in shared solutions with customers and create breakthrough service offerings and processes [1,2,4,10,21].

Melton and Hartline (2010) demonstrated that service innovation incorporates knowledge from customers and frontline employees, which ultimately impacts sales, cost and competitive performance. They also suggested that integrating customers, employees, suppliers and partners in the innovation process is beneficial to a firm's service performance. Hence, service provider selection is essential to the process of developing competitive advantages. By contributing to novel ways of value creation for firms and their service providers, innovation is an effective way to accelerate growth and profitability in service firms. This study attempts to conceptualize service innovation criteria that examine service innovation implementation and the manner in which service firms create value through innovation, that is, customer-centric; this area has received scant empirical attention [4,9,31,38].

### 2.2. MCDM

The combination of fuzzy set theory, TODIM and the Choquet integral is a novel approach. TODIM is a discrete multi-criteria method founded on prospect theory. The TODIM method has been successfully used and empirically validated in different applications [32]. Although not all multi-criteria problems address risk, the shape of the value function of TODIM is identical to the gain and loss function of prospect theory. Gomes et al. (2009) apply TODIM to investigate and to recommend options for upstream projects in the natural gas reserves of the Mexilhão field in the Santos Basin of Brazil. Gomes and Rangel [27] presented an evaluation of residential properties with real estate agents in Brazil and defined a reference value for the rents of those properties using the TODIM method of multi-criteria decision. Tseng et al. [3] addressed fuzzy set theory and TODIM to assist managers in improving environmental performance and reducing overall risks of green supply chain management.

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