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Managing logistics customer service under uncertainty: An integrative fuzzy Kano framework

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ABSTRACT

A logistics customer service model is a critical competitive advantage that enhances both customer satisfaction and firm performance. Researchers have developed several models for assessing customer requirements, measuring product performance, and positioning products. However, handling customers' linguistic preferences and uncertain product attributes remain significant and unresolved problems. In this study, we develop an integrative framework that incorporates the Kano model, fuzzy distances, and 2-tuple fuzzy-linguistic model to manage customer-service logistics more effectively. Following a five-module architecture, we consider numerical, fuzzy, and linguistic data on product attributes and customer requirements. We first evaluate product attributes using utility-value functions and converted into satisfaction scores related to Kano categories. We then consider raw importance assessments to obtain an overall satisfaction score for each market and product. An empirical example illustrates the benefits of this integrative approach. The results show that our proposal can effectively manage logistics customer service, enabling managers to identify targets and formulate competitive strategies to enhance customer satisfaction.

1. Introduction

Managing logistics customer service is widely recognised as a strategic source of competitive advantage and market success [19,63]. Customer service refers to the firm's ability to determine customers' needs accurately and respond to them adequately [31,39,42], serving as a measure of product utility. Customer service management has three main stages [38,42]: (i) assessing customer requirements for product attributes; (ii) measuring product performance with regard to its current attributes; and (iii) positioning competitive products with respect to market segments. Ultimately, the observed competitive situation can identify potential sources of opportunities and threats [41,59].

Researchers have proposed various methods for *assessing customer requirements*, including surveys, focus groups, individual interviews, creative group interviews, listening and watching, complaint analysis, natural field contacts, warranty data, and affinity diagrams [8,36]. Some assessments focus on physical, quantitative product attributes; other assessments include subjective feelings and emotions, including those considered by the popular Kansei engineering methodology on product design characteristics [55,56,62]. Although surveys commonly collect customer information, they may be affected by earlier experiences [4,60]. A customer service attribute with which a respondent has had previous unsatisfactory experiences may receive greater importance than a more neutral service attribute. Inversely, positive experiences may reduce the importance that customers give to a particular service element [31]. Thus, direct surveys can produce biased responses, and their results may be misinterpreted.

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After identifying customer requirements, rating techniques, including the analytic hierarchy process [33,30], multidimensional scaling [22,38] and conjoint analysis [16,20], obtain associated importance values. Despite their broad use, existing methods fail to consider the uncertainty of customer preferences [44]. Customer judgements tend to be imprecise and ambiguous due to their linguistic origins [34], so crisp data are insufficient to capture preferences. Researchers have used several fuzzy approaches to assess the vague importance of attributes, including fuzzy numbers [10,13,14,46], fuzzy arithmetic [8,11], fuzzy outranking [64], fuzzy linear programming [11,66], the fuzzy Delphi method [36] and fuzzy analytical hierarchy process [40]. However, fuzzy proposals suffer from methodological problems, mostly related to accurately defining fuzzy sets [11,45,61].

Because customers are thought to select the product nearest to their ideal prototype to maximise satisfaction [2], *product performance* assessments compare product data with selected attributes. Product-performance scores are based on distance measures, including the Euclidean distance [22,46], simple matching coefficient [49], and Jaccard's coefficient. Researchers have recently introduced fuzzy distances, the fuzzy geometric distance [29] and Hamming distance [15,53], but the literature is not yet extensive.

Based on product scores, performance models, including the 'importance-performance analysis' (IPA) [50,70], assume one-dimensional attributes, such that customer satisfaction is linearly dependent and symmetrical on the level of service offered: the higher the service level, the higher the customer satisfaction. In practice, however, attribute improvements may be insufficient to enhance customer satisfaction, which also depends on the nature of each element [9,31,51].

Based on performance scores, *products are positioned* according to the requirements of market segments. Perceptual maps [18], multidimensional scaling maps [1], and competitive matrices [31,41] are common positioning techniques. Although these models plot points on two- or three-dimensional maps, fuzzy data have not been included empirically [29].

The Kano model [35] has been proposed to address some previous limitations on logistics customer service. This model corrects for customer experience bias and computes the non-linear impact of service elements on customer satisfaction [30]. In the Kano model, attributes are classified into five classes with distinct impacts on consumer satisfaction [3]: 'attractive', 'one-dimensional', 'must-be', 'indifferent', and 'reverse' attributes. Kano categories are combined with product performance scores to identify the most sensitive attributes for customer satisfaction and the most important elements for building a competitive advantage. The Kano model also faces problems regarding quantitative data computation [67] and attribute importance assessment [68]. Although some analytical and fuzzy proposals have attempted to partially resolve these difficulties [44,68], a complete solution has not yet been obtained.

In this paper, we present an integral framework based on the Kano model for managing logistics customer service and positioning competitive products within uncertain environments. Following a five-module architecture, our proposed method can manage multiple-criteria decision-making using numerical data, fuzzy numbers, and linguistic terms. Fuzzy distances, fuzzy transformation functions, and the 2-tuple fuzzy-linguistic model obtain robust and comprehensive results within the proposed framework.

The article is structured as follows. In Section 2, we briefly introduce the theoretical background of the Kano model, the fuzzy-computing approach, and the 2-tuple fuzzy-linguistic model used throughout the paper. Section 3 describes the proposed framework in detail. Section 4 presents an example to empirically verify the feasibility and effectiveness of our approach. Section 5 presents concluding remarks and suggestions for future research.

2. Theoretical background

This section briefly defines and reviews the major methods and notations used to develop the proposed framework for logistics customer service.

2.1. The Kano model of customer satisfaction

Kano et al. [35] develop a two-dimensional model widely used to characterise attributes of a product or service based on how well these attributes satisfy customer requirements [9,43,51]. The Kano conceptual model employs inquiring techniques with pairs of functional and dysfunctional questions about each requirement; the functional situation considers the quality present or sufficient, while the dysfunctional situation supposes the quality to be absent or insufficient [35]. Huiskonen and Pirttilä [31] propose that questions should be related to better (functional question) and worse (dysfunctional question) situations than the industry average service level to correct for experience bias and obtain a measure of differential desire. In a Kano questionnaire, customers choose one of the following responses to express their feelings [9,51]: (a) I like it/I am satisfied; (b) it must be that way; (c) I am indifferent/neutral; (d) I can live with it; and (e) I dislike it/I am dissatisfied. From the answer table, the Kano model classifies service attributes into categories that exhibit different impacts on consumer satisfaction depending on whether customer needs are fulfilled [3] (Table 1). Categories are evaluated according to response frequencies [9,30,45,51], but fuzzy assessments can also be considered [10,43,44]:

1. Must-be or basic attribute: Insufficiency of a must-be attribute results in extreme non-satisfaction, but basic product performance is enough to satisfy customer requirements. Customers believe that such an attribute is a necessity, but high attribute performance does not generate correspondingly high customer satisfaction.