



# Exploring asymmetric effects of attribute performance on customer satisfaction using association rule method

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## ARTICLE INFO

### Keywords:

Customer satisfaction  
Asymmetric effect  
Kano model  
Attribute performance  
Association rule

## ABSTRACT

Identifying primary service attributes that generate customer satisfaction (CS) is critical to organizational success. The Kano model demonstrates an asymmetric relationship between attribute performance and CS. However, extant regression-based approaches for classifying Kano's quality attributes have theoretical limitations, such as multicollinearity problems, resulting in spurious inferences. The association rule (AR) method is widely used in data mining to explore the associations or correlations among variables because it does not require the typical assumptions associated with regression analyses. The framework developed in this study incorporates the AR method to classify Kano's quality attributes. The effectiveness of the proposed method was demonstrated using a case study of a restaurant chain. The proposed method is more practical for classifying Kano's quality attributes because it shortens the time required for data collection. Moreover, the proposed method reduces computational complexity. Validity test results indicate that the proposed method markedly outperforms some regression-based approaches.

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## 1. Introduction

Customer satisfaction (CS) is critical to the success of every organization and has been widely discussed in previous studies because of its increasing importance to managers (Nagar and Rajan, 2005). Traditionally, CS has been conceptualized as a global affective response to products or services (Westbrook, 1987). Most researchers have agreed that CS is best evaluated using a multi-dimensional scale (Chen, 2014; Slevitch and Oh, 2010). CS depends on numerous determinants at the attribute level, and measuring CS through attribute performance (AP) captures the multifaceted nature of the consumption experience (Slevitch and Oh, 2010). Therefore, managers should continually identify which critical service factors generate CS and customer loyalty to remain competitive (Bacon, 2012).

Most studies have indicated that the relationship between AP and CS is linear and symmetric. This indication relies on the implicit assumption that an adequate level of AP generates a certain level of CS, and that this is inversely proportionate to the level of customer dissatisfaction (CD) that would be generated by an equally inadequate level of AP (Slevitch and Oh, 2010). Kano et al. (1984)

showed that the relationship between AP and overall CS can be asymmetric and nonlinear depending on the type of attribute, and they distinguished (a) one-dimensional, (b) must-be, (c) attractive, (d) indifferent, and (e) inverse quality attributes. Fig. 1 depicts the asymmetric effects of AP on CS according to Kano's two-dimensional quality model. When CS is proportional to the level of fulfillment, it is a one-dimensional factor. Although fulfillment of the must-be factor does not increase CS, nonfulfillment of this factor results in CD. By contrast, fulfillment of the attractive attribute increases CS, but nonfulfillment of this factor does not generate CD. In situations where the quality attribute generates neither CS nor CD, it is classified as an indifferent factor, irrespective of whether this attribute is fulfilled. In situations where fulfillment of the service attribute results in CD (or CS when the attribute is not fulfilled), it is classified as a reverse factor (Chen, 2012). One-dimensional factors are strategic items that can be manipulated to maximize CS: must-be factors are bottleneck items that managers should ensure are adequately fulfilled; attractive factors are leverage items that can be applied to improve competition differentiation; and indifferent factors are noncritical items that managers should consider eliminating unless their efficiency can be improved (Chen, 2014).

Since its introduction, the Kano model has been successfully implemented and empirically tested in numerous studies across various service settings, such as tourism (Chen, 2014; Füller et al., 2006), health care (Jane and Dominguez, 2003a; Jane and Dominguez, 2003b), and bank services (Matzler et al., 2003). To enhance CS, organizations must consider Kano's theory to identify

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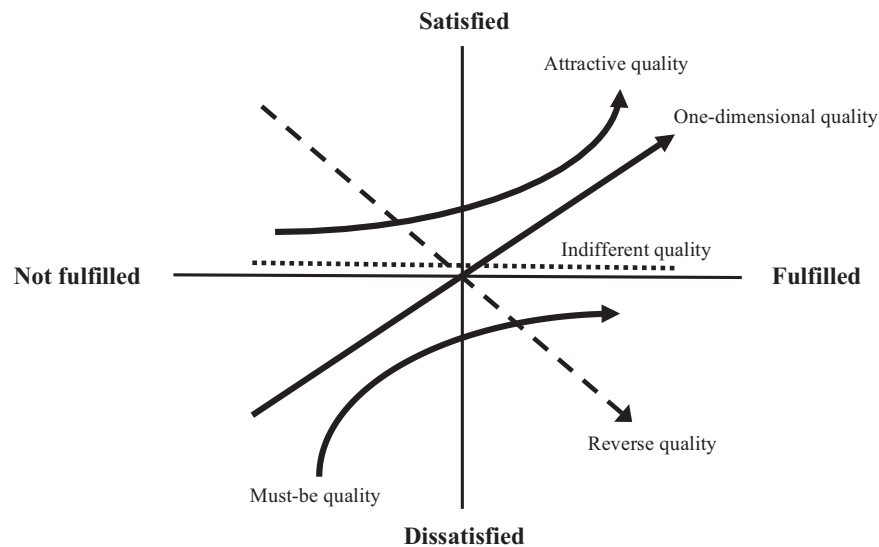


Fig. 1. Kano's two-dimensional quality model (Chen, 2012).

critical factors (Chen, 2012, 2014). Other studies on CS have also shown that the effects of AP on CS are asymmetric (Füller et al., 2006; Slevitch and Oh, 2010) and nonlinear (Lin et al., 2010; Ting and Chen, 2002). Kano et al. (1984) designed a questionnaire comprising functional and dysfunctional questions for each attribute in order to identify categories of quality. Kano's questionnaire remains the most appropriate approach for classifying quality attributes. However, this approach has been considered overly complex, time-consuming, and difficult to implement in real world application (Witell and Löfgren, 2007; Mikulić and Prebežac, 2011). Despite the widespread use of Kano's questionnaire, an increasing number of studies have used regression-based approaches to derive a more analytical view for examining the asymmetric effects described in the Kano model. These approaches include penalty-reward contrast analysis (PRCA; Brandt, 1988) and moderated regression (MR; Lin et al., 2010). Although these regression-based approaches can discriminate the relative importance of attributes to explain overall CS, they rely on certain assumptions regarding the variables used in the analysis, such as normality, linearity, independence, and constant variance. If any of these assumptions is violated, then any inferences based on such regression models may be spurious, which occurs in most studies on CS. Garver (2003) indicated that CS data distributions are typically highly skewed, and that high multicollinearity exists among CS attributes. Therefore, a new analytical method must be developed for exploring the effects of AP on CS instead of having to resort to regression-based approaches.

The association rule (AR) method is a widely used data-mining technique for analyzing correlations among variables. AR mining is aimed at identifying sets of binary variables that co-occur frequently in a transaction database (Tan et al., 2004), and it has been widely used in market basket analyses (Chen and Wu, 2005). A distinct advantage of the AR method is that it can identify associations or correlations in large data sets without being constrained by the assumptions of regression analyses. It is not prone to multicollinearity problems, either (Rudin et al., 2011). Hence, the AR method avoids model misspecification. Moreover, because most business managers are not data mining experts, developing a user-friendly system is crucial. Rule-based methods are widely used because domain experts find them easy to interpret (Ahmad et al., 2012). Therefore, the AR method is potentially more effective than regression-based approaches for capturing the asymmetric relationship between AP and CS. However, such an application appears to be lacking in the literature.

This study proposes a framework for identifying Kano quality attributes by adopting the AR method to explore the asymmetric effects of AP on CS. A case of a restaurant chain was used to demonstrate the effectiveness and practicality of the proposed approach, which were evaluated by comparing the convergent validity of Kano's questionnaire with that of the proposed approach. Finally, three regression-based approaches were selected for a comparison aimed at evaluating the classification performance of the proposed approach.

## 2. Related works

### 2.1. Asymmetric effects of attribute performance on customer satisfaction in Kano's model

Recent work on CS has shown that overall CS can be expressed as a function of AP. Kano et al. (1984) reported that the relationship between AP and CS is asymmetric and nonlinear. To elicit customer opinions on a particular function or feature, Kano et al. (1984) designed a questionnaire that comprised functional and dysfunctional questions for each attribute in order to identify categories of quality. Respondents were asked to express how they would feel if a particular attribute were present or fulfilled, and to choose one of the following answers: (a) *Satisfied*, (b) *It should be that way*, (c) *I am neutral*, (d) *I can live with it*, or (e) *Dissatisfied*. Subsequently, they were asked to express how they would feel if that attribute were unfulfilled or absent, and to select one of the five responses. The combination of the two responses enabled classification of the attribute, in accordance with Kano's evaluation table (Table 1). The most common approach for determining Kano's categories is to observe the frequency distribution of each attribute. The highest frequency represents the dominant customer view. Zhao and Dholakia (2009) and Chen (2012) additionally considered *category strength* and *total strength*, which were proposed by Lee and Newcomb (1997), to investigate mixed class, wherein the dominant distribution cannot be determined for any quality attribute.

The increasing number of studies applying the Kano model in many fields has led to the proposal of various approaches for exploring the asymmetric and nonlinear relationship of quality attributes, despite the prevalent use of Kano's functional/dysfunctional questionnaire [e.g., PRCA (Brandt, 1988), importance grid analysis (Vavra, 1997), and the direct classification method (Emery

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