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# Customer satisfaction and loyalty analysis with classification algorithms and Structural Equation Modeling

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ABSTRACT

Businesses can maintain their effectiveness as long as they have satisfied and loyal customers. Customer relationship management provides significant advantages for companies especially in gaining competitiveness. In order to reach these objectives primarily companies need to identify and analyze their customers. In this respect, effective communication and commitment to customers and changing market conditions is of great importance to increase the level of satisfaction and loyalty. To evaluate this situation, level of customer satisfaction and loyalty should be measured correctly with a comprehensive approach. In this study, customers are investigated in 4 main groups according to their level of satisfaction and loyalty with a criteria and group based analysis with a new method. We use classification algorithms in WEKA programming software and Structural Equation Modeling (SEM) with LISREL tools together to analyze the effect of each satisfaction and loyalty criteria in a satisfaction–loyalty matrix and extend the customer satisfaction and loyalty post-analysis research bridging the gap in this field of research. To convert developed conceptual thought to experimental study, white goods industry is exemplified. 15 criteria are used for evaluation in 4 customer groups and a satisfaction–loyalty survey developed by experts is applied to 200 customers with face-to-face interviews. As a result of the study, a customer and criteria grouping method is created with high performance classification methods and good fit structural models. In addition, results are evaluated for developing a customer strategy improvement tool considering method outcomes.



## 1. Introduction

In order to achieve sustainable competition advantage in the market, it is necessary to provide and improve customer satisfaction (CS). CS Analysis is used for measuring customer satisfaction levels, taking counter actions for the low satisfaction points and improving high satisfaction points. When the customer becomes the focus of organization and if it gains more satisfied customers, then high satisfaction contributes in both internal and external processes of a company (Ersoz, Yaman, & Birgoren, 2008; Gale & Wood, 1994). High satisfaction brings many advantages, for example, customer oriented organizations can achieve high financial performance (Johnson, 2000). Therefore, CS analysis is conducted by many of the firms for gaining several competitive advantages in the market (Kengpol & Wangananon, 2006). In addition, to retain customer, organization structuring is to be established in accordance with customer satisfaction (Kotler & Armstrong, 1994).

In the literature, there are several approaches for CS analysis with various satisfaction criteria. Successful and nation-wide applications in this field consider CS analysis as a cause-and-effect model. In CS analyses, different types of customer evaluations cannot be measured directly, so they are modeled as latent variables (variables that affect CS or affected by CS but cannot be measured directly). Therefore, CS analysis becomes meaningful and powerful when analyzed with antecedents and consequences (Ciavolino & Dahlgaard 2007; Fornell, 1992; Fornell, Michael, Eugene, Jaesung, & Barbara, 1996; Grigoroudis & Siskos 2002; Liu, Zeng, Xu, & Koehl, 2004; Martensen, Kristensen, & Grönholdt, 2000; Turkyılmaz and Ozkan (2007); Shao-I, Ching-Chan, Tieh-Min, & Hsiu-Yuan, 2011). Grigoroudis & Siskos 2004 also give a list of studies based on cause and effect models of satisfaction. One of the most addressed consequent of CS in the literature is customer loyalty (CL). CL is can be expressed as the likelihood to recommend company to other customers, the likelihood to

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repurchase or revisit of customers (Anderson & Mittal, 2000). As many researchers indicate, there is a significant relationship between customer satisfaction and customer loyalty. Kumar, Pozza, and Ganesh (2013) state that the association between customer satisfaction and loyalty is highly variable depending on some factors as the industry, customer segment studied, the nature of the dependent and independent variables, and the presence of numerous factors that serve as mediators. The authors also give a list of studies conducted on satisfaction–loyalty relationship. Cronin and Taylor (1992), Garbarino and Johnson (1999), Ngobo (1999), Cronin, Brady, and Hult (2000), Churchill and Halpern (2001), Lam, Venkatesh, Krishna, and Bvsan (2004), Homburg and Furst (2005), Anderson and Mittal (2000), Vesel and Zabkar (2009), Deng, Lu, Wei, and Zhang (2010), Chen (2012), and Orel and Kara (2013) discover strong linear relationships between customer satisfaction and customer loyalty in various sectors and industries. However, customer satisfaction (CS) does not completely determine customer loyalty (CL) (Chen, 2012; Deng et al., 2010; Gerpott, Rams, & Schindler, 2001; Johnson, 2000; Kumar et al., 2013; Lam et al., 2004; Orel & Kara, 2013). The effect from CS to CL is not always fully determined. This means, in CS analysis there are some group of customers who are lowly satisfied–highly loyal and highly satisfied–lowly loyal. So, we can categorize customers into mainly 4 different groups: Group 1: Low Satisfaction–Low Loyalty, Group 2: Low Satisfaction–High Loyalty, Group 3: High Satisfaction–Low Loyalty and Group 4: High Satisfaction–High Loyalty. These 4 groups construct 4 different section of the CS–CL matrix which is presented in Section 2 in detail.

The major deficiency of post analysis methods on CS and CL is the lack of quantitative calculation method of evaluation in a systematic way. The model proposed in this study has the advantage of bridging the gap in this area by presenting an integrated approach using data mining and structural models together.

In this study we extend the CS and CL analysis by integrating relationship results with CS and CL criteria in a CS–CL matrix. This matrix is used for both creating customer segments and positioning CS and CL criteria to the related part of the matrix. This improvement helps us to discover a more comprehensive CS–CL relationship and develop strategies for increasing the total share of 4th Group customers. Thus, we can develop prudential strategies for increasing total share of 4th Group.

Another innovation point in this study is that we analyze CS and CL together with an algorithm using data mining classification algorithms and Structural Equation Modeling (SEM) together. Here we use decision trees produced after classification applications to create customer groups and to find breaking points of the CS–CL matrix. Ngai, Li, and Chau (2009) conduct a detailed literature study on the use of data mining algorithms in customer relationship management. They state that classification algorithms are used for customer segmentation and customer development. In this study we contribute to the literature in this field by determining breaking points of CS–CL matrix with classification algorithms. For classification applications WEKA data mining tool is used developed by Hall et al. (2009). By using classification tool we uncover meaningful and hidden patterns by using data mining techniques in customer data. Results of the study have potential inputs for many customer-focused applications.

A further extension in CS–CL analysis in this study is customer strategy development according to matrix-based model results with SEM. SEM is used to discover CS and CL criteria groups and their relations in the developed structured models. In strategy development process, main objective is not only increasing CS level but also increasing the number of loyal customers and maintaining customer retention in the long term with satisfied and loyal customers. The model helps us to discover these hints for strategy development. As Chikara and Takahashi (1997), Grigoroudis, Samaras, Matsatsinis, and Siskos (1999), and Grigoroudis and Siskos (2002) state that the most important part of CS analysis is building a post-analysis method to create future directions for companies. In this study we evaluate matrix results with classification and SEM results and offer criteria-based customer group strategies. To build structural equation models SIMPLIS language of LISREL 8.80 (by Jöreskog & Sörbom, 2006) software is used.

The paper is organized as follows: In Section 2, we present the scope and purpose of study. We define the capabilities of developed CS–CL matrix here. In Section 3, we present CS–CL analysis algorithm step by step. The application data are collected by a survey in white-goods industry. In Section 4, we discuss data collection procedure and application results of the model in white-goods industry. And in the final section of the study we discuss results, findings, advantages and future directions of this study.

## 2. Scope and purpose of the study

The considered problem in this is study is developing a new post-analysis method for customer satisfaction (CS) and customer loyalty (CL) analysis. The importance of post analysis methods in customer satisfaction evaluation is emphasized by Hill (1996), Chikara and Takahashi (1997), Grigoroudis et al. (1999), and Grigoroudis and Siskos (2002). In these papers authors emphasize that a reasonable post evaluation of CS results is very important for future strategies at least the CS analysis itself. The model developed in this study integrates data mining tools with Structured Equation Modeling (SEM) technique and produces beneficial results for creating customer strategies as a CS and CL post-analysis guide. This bridges a significant gap in this area of research. Application of the model is conducted in white-goods sector in Turkey.

In this study we propose a new matrix-based approach for CS and CL analysis. The model developed in the study is a kind of customer satisfaction evaluation that uses data mining (discovering unknown patterns) advantages of classification algorithms and cause-and-effect modeling advantage of Structural Equation Modeling (SEM). This model is not only a pure evaluation of CS and CL but also an interactive matrix-based procedure that investigates CS and CL with post analyses.

For CS–CL analysis, in some of the studies, authors develop a matrix-based approach. Gerpott et al. (2001) develops customer satisfaction–customer loyalty and customer loyalty–customer retention matrices. They discuss relationship among customer retention–customer loyalty and customer loyalty–customer satisfaction in telecommunications market. They define some properties of customer groups in each matrix and build Structural Equation Model (SEM) which is created independently from matrix. Ersoz et al. (2008) use artificial network networks for classification of customers according to a CS matrix developed by Aktas et al. (2000). In these studies authors develop some customer groups and finds out distribution of customer groups in the matrix. Then they evaluate type and distribution of customers. However, in our study the main objective is not only segmentation of customers but also assigning each CS and CL criteria to the related part of the developed CS–CL matrix and creating a criteria-based matrix. Thus, developed CS–CL matrix shows customer groups and most effective criteria on CS and CL together. Here we use the results of best performing classification algorithms. Additionally we offer a customer strategy development tool by integrating the results of classification decision tress with SEM analysis.

CS–CL matrix developed in the study is given in Fig. 1 below. The diagonal blue line shows the target of strategies which aims to create customer retention at the end of high CS and high CL