Chapter 27
Development of Data Mining Driven Software Tool to Forecast the Customer Requirement for Quality Function Deployment

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ABSTRACT

Quality Function Deployment (QFD) is widely used customer driven process for product development. Thus, Customer Requirements (CRs) play a key role in QFD process. However, the diversification in marketplace makes these CRs more dynamic and changing, giving rise the need to forecast CRs to improve competitiveness and increase customer satisfaction. The purpose can be served by using Data Mining techniques of forecasting. With the pool of forecasting techniques available, it is important to evaluate a suitable one for more effective results. To this end, the paper presents a novel software tool to efficiently forecast CRs in QFD. The tool allows for forecasting using various data mining based time series analysis techniques that strongly assists in doing comparative analysis and evaluating out the most apt technique for forecasting of CRs. The tool is developed using VB.Net and MS-Access. Finally, an example is presented to demonstrate the practicability of proposed software tool.

INTRODUCTION

In today's revolutionary era, the recent technologies are emerging at the terrific rate of alacrity; as a result, achieving customer satisfaction has become critical task for organization. Global competitiveness has recently turn into the prime concern of many companies, which consider ''continuous improvement'' to

catch up with the rapid changing development throughout the world inspired by technological innovations and changing customers' requirements (CRs) (Kahraman, Ertay & Buyukozkan, 2004). To resolve this issue, nowadays companies mainly focus on the Mantra resembling 'interaction with customers', who acts as the base of pyramid of the emerging market place; and understanding requirements stated by them which may lead to the successful product. The Quality Function deployment (QFD) translates the customer requirements into engineering characteristics for a product or service, prioritizing these characteristics of product or service while concurrently establishing development goals for it (Karsak, 2004). It is structured approach which inspires new concept and technology with implementation of Total Quality Management (TQM). Its application assists the process of synchronized engineering and promotes teamwork to effort towards a common target of guarantying customer satisfaction (Hsu, Wang & Lin, 2007).

Customer requirements (CRs), being the primary input; plays very crucial role in various phases of QFD. Owing to rapid diversification in marketplace, it is quite obvious that CRs would be more dynamic. As the product designing is based on precedent requirements, it can be crystal clear that CRs may be different when the product is already in the market and may be different while designing. Due to this time lag trouble, it becomes essential to forecast the future CRs. Forecasting CRs in QFD can be advantageous for the company to offer improved products, boost their competitiveness in marketplace and raise customer satisfaction (Hsu, Wang & Lin, 2007). In the context of a customer-oriented products or service design process, a well-timed update of CRs may serve as a necessity indicator to monitor how things vary over time, and also it includes the firms a superior ground to interoperate diverse approaches to meet the future CRs (Bostaki & Roghanian, 2013). Forecasting future values in QFD would be advantageous in making the future strategies and can lend a hand in taking the preventive measures for the future circumstances. Researchers have applied many techniques in QFD for forecasting the future values (Abastante & Lami, 2012; Raharjo, Brombacher, Goh, & Bergman, 2010; Han and Shin, 2014).

Data mining has been proven successful approach of forecasting. Data Mining is the procedure that travels throughout data to discover unknown relations among the data that are interesting to the user of the data (Alsultanny, 2013). Data mining is based on fundamental concept of using the historic values in order to predict the future values. It offers the pool of forecasting techniques such as, decision trees, linkage analysis, hybrid approaches, time-series analysis, cluster analysis, neural network etc. In contrast to standard statistical methods, data mining techniques have been proven often more influential, versatile, and adequate for exploratory analysis. Data mining have been applied over many fields for forecasting future values such as stock markets, crime forecasting, weekly weather reports, finance, demand forecast and etc. (Khedkar, & Argiddi, 2013; Yu, Ward, Morabito, & Ding, 2011; Kalyankar, & Alaspurkar, S. 2013; Chen, & Du, 2009; Saigal, & Mehrotra, 2012; Olinsky, Schumacher, & Quinn, 2016). However, its application on QFD is very infrequent and has not been adequately addressed in the literature. Since last few years, researchers have encouraged the application of data mining in QFD for forecasting CRs (Huang, Li & Ye, 2012; Lai, Hsu & Kuo, 2012; Hsu, Chang & Kuo, 2012; Siraj, Nordin, & Yusoff, 2008; Bostaki & Roghanian, 2013).

This study focuses on the application of data-mining based time-series analysis techniques, such as *Simple Moving Average (SMA), Weighted Moving Average (WMA), Single Exponential Smoothing (SE), Double Exponential Smoothing using Brown's Method (DEB), Double Exponential Smoothing using Holt's and Winter's method (DEH&W)* and *Linear Regression (LR)*; on QFD in order to forecast the futuristic CRs. Time series data mining combines data mining techniques with time series analysis to:

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