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A Six Sigma DMAIC Process for Supplier Performance Evaluation using AHP and Kano's Model

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ABSTRACT

The suppliers, which are one of the most important actors in the supply chain, have a significant effect on the performances of their customer firms. Hence, supplier performance evaluation has become a competitive tool in today's goods and service producing industries. This paper presents a supplier performance evaluation process developed using the Six Sigma Define – Measure – Analyse – Improve – Control (DMAIC) methodology. The proposed process has been applied in a central services company, where the suppliers had never been evaluated before. To this end, first of all, the evaluation criteria have been defined through brainstorming and meetings within the company, then weighted with Analytical Hierarchy Process (AHP), and categorized according to Kano's Model. Afterwards, suppliers have been scored and classified based on a proposed methodology using a modified version of Kano's model, and thus, the proposed process has proven to be useful in real life industrial applications.

KEYWORDS

AHP, Kano's Model, Six Sigma DMAIC, Supplier Performance Evaluation

1. INTRODUCTION

Supply chain management (SCM) has become an indispensable competitive strategy in acquiring and sustaining organizational productivity and profitability (Gunasekaran, Patel, & McGaughey, 2004). Carter and Narasimhan (1993) emphasize the significance of purchasing in the supply chain stating that 'purchasing issues, strategies, and tactics are just as important as marketing, finance, accounting, and operational issues even though purchasing is first in the value chain and furthest from the actual delivery of the product or service to the customer' (Carter & Narasimhan, 1993 in Cheraghi, Dadashzadeh, & Subramanian, 2004, p.91). This remains to be a fact and becoming even more relevant (Caniato, Luzzini, & Ronchi, 2014) in today's, dynamic and competitive business environment, where the 'the advent of the Internet commerce and its impact on customer expectations' (Cheraghi et al., 2004, p.91) has only made its effects more distinguishable in ensuring the long-term

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supply chain competitiveness and thus viability of a firm (Cheraghi et al., 2004; Yang, 2010; Ku, Chang, & Ho, 2010).

As Görener (2008, p.31) puts it 'The most important function of a purchasing department is to provide the required materials at the right time, right quantity and requested quality at the least cost from the right supplier for the organization'. This is the core reason why supplier selection and evaluation have become indispensable in today's goods and service producing industries.

Performance management has proven to produce positive change in organizational systems and processes (Pinheiro de Lima, Gouvea da Costa, Angelis, & Munik, 2013), and thus, it has become one of the most widely recognized managerial processes (Bititci, Ackermann, Ates, Davies, Garengo et al., 2011) both in the manufacturing (e.g. Gomes, Yasin, & Lisboa, 2004; Chen, 2008; Bititci, Firat, & Garengo, 2013; Van Horenbeek & Pintelon, 2014) and service (e.g. Brignall & Modell, 2000; Sotirakou & Zeppou, 2006; Moxham & Boaden, 2007; Oztemel & Salmona, 2009) sectors. Consequently, with the intention of bringing a potential practical solution to the multi-criteria decision making problem of supplier evaluation (Agarwal, Sahai, Mishra, Bag, & Singh, 2011); a supplier performance evaluation process using the Six Sigma DMAIC methodology has been proposed in this paper.

Six Sigma 'has evolved from scientific management and continuous improvement theories by combining the finest elements of many former quality initiatives' (Aboelmaged, 2010, p.268). Among its many definitions reflecting different perspectives (Schroeder, Linderman, Liedtke, & Choo, 2008; Aboelmaged, 2010), the authors have chosen to adopt Linderman, Schroeder, Zaheer, and Choo's (2003, p.195) definition stating that 'Six Sigma is an organized and systematic method for strategic process improvement and new product and service development that relies on statistical methods and the scientific method to make dramatic reductions in customer defined defect rates'.

Six Sigma is a highly disciplined, data-oriented (Hahn, Doganaksoy, & Hoerl, 2000) and unique approach in that it utilizes a structured process improvement methodology integrating a well-defined set of tools at each step (Linderman et al., 2003; Zu, Fredendall, & Douglas, 2008; Shafer & Moeller, 2012). This is exactly the plan-do-check-act (PDCA) perspective organizations should adopt through their business processes to enable continuous scanning, monitoring, control, improvement and evolution (Bititci et al., 2011), relating the relevant tools into an overall approach to improvement (Hahn et al., 2000). One significant issue that differentiates Six Sigma from the other process improvement programs such as Total Quality Management (TQM), Lean, and the Baldrige model is its ability in establishing an organizational context that facilitates problem solving and exploration across the organization (Parast, 2011), using quantitative measures of how the system is performing in terms of process improvement and variation reduction (Zare Mehrjerdi, 2011). Moreover, during this process the focus is on the viewpoint of customers in that the critical-to-quality characteristics are systematically translated into improvement projects (Parast, 2011).

Since its initiation at Motorola in the 1980s, Six Sigma has attracted significant attention in industry due to its above-stated strengths; and many organizations worldwide including 3M, Allied Signal, American Express, Caterpillar, Dow Chemical, Ford, General Electric, Honeywell, IBM, Johnson Controls, Nokia and Sony have adopted Six Sigma methodology and tools for their strategic and tactical operations and experienced its benefits in various areas including employee morale and productivity, on time delivery, cycle time for hiring and training new employees, logistics, sales forecasting ability, quality of customer service, strong customer satisfaction, profitability and overall organizational performance (Hahn et al., 2000; Raisinghani, Ette, Pierce, Cannon, & Daripaly, 2005; Llorens-Montes & Molina, 2006; Schroeder et al., 2008; Zu et al., 2008; Aboelmaged, 2010; Zare Mehrjerdi, 2011; Shafer & Moeller, 2012; Clegg, Gholami, & Omurgonulsen, 2013; Krueger, Parast, & Adams, 2014).

The structure process improvement of Six Sigma is realized through DMAIC and Design for Six Sigma (DFSS) (Aboelmaged, 2010). DMAIC, an acronym for a Six Sigma problem solving methodology using the stages of 'Define, Measure, Analyse, Improve and Control' (see Figure 1) (Kumar & Schmitz, 2011), is a direct outgrowth of the Shewhart PDCA cycle (Watson & DeYong,