A Quality and Partnering-Based Model for Improving Supply Chain Performance

Kanchan Das, Department of Technology Systems, East Carolina University, Greenville, NC, USA
Scott A. Dellana, Department of Marketing and Supply Chain Management, East Carolina University, Greenville, NC, USA

ABSTRACT

This study proposes a Supplier Quality Affiliation (SQA) approach that is integrated into a mixed integer programming Strategic Supply Chain Management (SSCM) model for overall improvement of the supply chain business process. A pool of acceptable quality and high quality suppliers are affiliated using multi-dimensional quality attributes for the supplier operation parameters in the SQA model. Based on the pre-defined partnering attributes, the SQA model next identifies a select group of high quality suppliers that can be converted into partners. The outcome of the SQA model is then integrated into the SSCM model for ensuring input quality while providing several options for overall business gains of the supply chain members, which include suppliers, manufacturers, and retailers. Applicability of the SQA model is investigated using a real world case study and the SSCM model is illustrated with a numerical example using random data.

Keywords: Business Gain, Mixed Integer Programming Model, Partnering Attributes, Quality Attributes, Supplier Integration

1. INTRODUCTION

The practice of partnering with suppliers to improve overall business and supply chain (SC) performance has received considerable attention in the recent literature (Radhakrishnan et al., 2011; Ajmal & Kristianto, 2010; Yue et al., 2010; Eltantawy et al., 2009; Maheshwari et al., 2006; Szweczykowski et al., 2005; Petersen et al., 2005; Blancero & Ellram, 1997). With the globalization of markets, combined with the advancement of information technology and ready availability of manufacturing technology, the supply management process has spread globally for many businesses. In this situation, a supplier to global companies can provide resource inputs for sets of industries in diverse geographic regions. On the other hand, each manufacturing plant operated by a global company can require input resources from several suppliers located in diverse geographic locations. Given this potentially complex globalized business

DOI: 10.4018/jsds.2013070101
process, effective quality-based supplier evaluation is crucial for ensuring quality of inputs to product and process.

The importance given in the literature to supplier performance evaluations encourages the use of a supplier affiliation approach that considers supplier quality attributes as a primary metric (Bernardes and Zsidisin, 2008; Kaynak, 2003; Kaynak, 2002; Wasmund, 1995). Such measures should be based on the quality-related process parameters which are relevant to realization of supplier inputs and should also include plant safety performance parameters to ensure consistent shipment ability, operator safety, and consumer safety. As part of the partner development process, the approach should involve identified partnering attributes and metrics defined by critical-to-business factors for SC relationships. Finally, managers in a SC should seek to employ a systematic procedure for identifying and defining attribute-based metrics for quality and partnering that facilitate effective supplier evaluation and subsequent development of buyer-supplier partnerships.

As a part of an effective approach to building buyer-supplier partnerships, one can establish criteria for affiliating suppliers at a variety of quality levels based on their expected performance. These levels would ideally identify both high quality suppliers that may be suitable for partnering and those of acceptable quality for creating supply flexibility. Considering a reasonable number of products, several supplier inputs for each product, multiple quality attributes for each input, and several critical-to-business attributes, SC managers may need to deal with several multidimensional attributes and metrics for supplier process. As discussed before, in the current business environment, globally located manufacturing plants operated by SCs receive inputs from suppliers located at diverse geographic locations. The complexity further increases when final products reach the various global market locations. To ensure uniform input and shipment quality, SC members would benefit greatly from an integrated supply chain model at the strategic decision level for ensuring consistent product and process quality across their entire global operations. Such a model should be formulated so that both buyer and supplier can evaluate their financial benefit or gain for following a quality and partnering-based approach.

This research contributes by presenting the development of a Strategic Supply Chain Management (SSCM) model that may be used to establish insight for buyers and suppliers as to how both can gain financially from a quality-based supply management approach. This SSCM model integrates a Supplier Quality Affiliation (SQA) model for affiliating identified suppliers at acceptable quality (AQ) and high quality (HQ) levels. It also identifies HQ suppliers that are suitable for partnering. The study also validates the SQA model using real-world case study data and illustrates applicability of the SQA and SSCM models in a complex supply chain environment using a numerical example with simulated data.

The research is organized in the following way. In Section 2, a survey of the relevant literature is given. Section 3 presents and explains the formulation of the SQA and SSCM models. Section 4 presents and tests a hypothesis on selecting partners for validation of the SQA model using real-world business data. In Section 5, a numerical example using simulated data is presented that illustrates the applicability of the SSCM and SQA models in a complex but representative supply chain scenario. Section 6 provides conclusions and recommendations.

2. LITERATURE SURVEY

The SC literature is extremely rich in supply management-related research. This study will review the most cited and recent research on: a) quality consideration in supplier selection, b) partnering with suppliers, and c) modeling-based approaches to supplier integration. These are presented by topic in chronological order, starting with the most recent:
Related Content

Modeling Foreign Exchange Rate Pass-Through using the Exponential GARCH
www.irma-international.org/chapter/modeling-foreign-exchange-rate-pass-through-using-the-exponential-garch/102155/

Backward & Forward Linkages in Chinese Steel Industry Using Input Output Analysis
Lafang Wang, Rui Xie and Jun Liu (2011). International Journal of Strategic Decision Sciences (pp. 36-55).
www.irma-international.org/article/backward-forward-linkages-chinese-steel/54741/

Value of Information in Distributed Decision Support Systems
www.irma-international.org/chapter/value-information-distributed-decision-support/38421/

Modeling Cooperative Decision Support Systems with Hybrid Agents
www.irma-international.org/article/modeling-cooperative-decision-support-systems-with-hybrid-agents/95093/

Towards Collaborative Multidimensional Query Recommendation with Triadic Association Rules
www.irma-international.org/article/towards-collaborative-multidimensional-query-recommendation-with-triadic-association-rules/133849/