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A Simulation Study of Supply Chain Management to Measure the Impact of Information Sharing

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ABSTRACT

It has been found that supply chain collaboration has a significant impact on the ability of an organization to meet customer needs and reduce costs. A key step in supply chain collaboration is sharing information among supply chain partners. In this paper a simulation study is presented to investigate the effectiveness of information sharing. The results show that from the perspectives of end inventory and back-order quantities, distributors and wholesalers gain significantly from information sharing, while not much gain can be realized for retailers.

Keywords: information sharing; simulation study; supply chain management.

INTRODUCTION

During the last decade, supply chain management, collaboration, coordination, and integration have been a concern of the world of business as well as the academic community. Early efforts concentrated on improving the internal efficiency of an individual firm or a single entity in the supply network. Nowadays, managers seek ways to change, redesign, and re-engineer the entire supply chain network. Supply chain collaboration has a major impact on an organization's ability to meet customer needs and to reduce costs.

A key step in this collaboration process is to share information among the supply chain partners. In addition, information sharing is also viewed as a major strategy to counter the bullwhip effect (Lee, Padmanabhan, & Whang, 1997a, 1997b; Simchi-Levi, Kaminsky, & Simchi-Levi, 2000; Chen, Drezner, Ryan, & Simchi-Levi, 2000; Gavirneni 2002). The advances in information technologies make information sharing possible, and these advances actually become a key driver of supply chain integration. However, sharing information through inter-organizational channels has brought about new concerns for business management. Due to the competitive and adversarial nature of the business itself, managers tend to overestimate the possible risks without seeing the potential benefits

and thus are reluctant to share information with their trading partners. Under this context, evaluating the effectiveness or the value of the information sharing becomes important before the managers are willing to push for any IT investment on supply chain collaboration.

In this paper we focus on addressing the above issues by investigating different degrees of information sharing in a multi-level, multi-player supply chain model. In this research study, we define a supply chain as follows: *multiple trading partners with suppliers/manufacturers and customers at the opposite ends with wholesalers and retailers located between them, and all entities are interconnected through the flow of materials and/or information.*

The rest of the paper is organized as follows: In the next section we describe some of the relevant work, which is followed by our research methodology including the design of the simulation study, experimental results, and conclusion.

PREVIOUS WORK

The work on information sharing in supply chain management can be divided into: using concurrent engineering as a framework for information sharing, system models for information sharing, and studying the value of information sharing on supply chain performance.

The literature on concurrent engineering (CE) provides a generic framework for information sharing within an organization. Concurrent engineering is a process for collaboration, coordination, and co-decision-making within and between cross-functional teams, with the purpose of sharing information effectively and efficiently to assure engineering and manufacturing conformity with design specifications, and to optimize the use of scarce resources (Anumba, Siemieniuch, & Sinclair, 2000; Davis, 1988; Scheer, 1991; Miao & Haake, 1998). Forgionne (1994) proposed the architecture for a Concurrent Engineering Decision Technology System (CEDTS), which consists of components for inputs, process, outputs, and feedback loops. It has been applied successfully in electronics manufacturing (Forgionne, 1993) and health care (Forgionne & Kohli, 1993; Kohli & Forgionne, 1992), and can possibly be extended and applied to the trading partners in a supply chain.

Lee and Whang (1998) proposed three system models of information sharing: the Information Transfer Model, the Third Party Model, and the Information Hub Model. In the Information Transfer Model, a trading partner transfers information to another that maintains the database for decision making. This is a natural evolution from the EDI-based transactional model. The problem with this model is that a company doing business with multiple partners has to provide different interfaces and support multiple standards. The Third Party Model involves a third party whose main function is to collect information and maintain it in a database for the supply chain. The Information Hub Model is similar to the Third Party Model, except that the third party is replaced by a system as an information hub.

Although information sharing is often considered as a generic cure for the bullwhip effect and it is generally accepted that information sharing can optimize the supply chain-wide performance (Forrester, 1958; Lee et al., 1997a, 1997b; Simchi-Levi et al., 2000; Chen et al., 2000), some literature shows that the value of information sharing varies under different scenarios. Baganha and Cohen (1998) find that under certain conditions, the variance of demand faced by a manufacturer is less when fil-