An Automated Supply Chain Management System and Its Performance Evaluation

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ABSTRACT

The MIDAS system is an automated supply chain management system that enables customers, manufacturers, and suppliers to cooperate over the Internet. MIDAS aims to achieve high customer satisfaction by supporting the build-to-order customization model and to reduce inventory carrying costs and logistics administration costs at the manufacturer by supporting the just-in-time manufacturing model. It allows a manufacturer to choose from the MIDAS Registry, suppliers of components, and negotiate based on the prices, availability, and delivery times of those components. The manufacturer can use one of several strategies to aggregate customers’ orders before processing them, and one of several strategies to accumulate suppliers’ quotes before deciding on a particular supplier. The paper presents an evaluation of these strategies in terms of the customer’s satisfaction, as measured by the customer response time, and the manufacturer’s gain, as measured by the number of orders aggregated or the best price ratio.

Keywords: Business-to-Business B2B, E-Business, Service Oriented Architecture, Supply Chain Management, Web Services, Web-Based Supply Chain Management

INTRODUCTION

Over the last decade, globalization and the Internet have led to a major shift in business management thinking which, in turn, has had a significant impact on how companies do business. Globalization has affected how businesses interact with other businesses, and has resulted in increased consolidation and competition, as many industries have gone through a process of removing restrictions and regulations worldwide (Murch, 2004). New business models have emerged with the Internet, the World Wide Web, and related technologies, such as the Service Oriented Architecture and Web Services (Moser & Melliar-Smith, 2009).

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One of the new business models is the build-to-order model (Gunasekaran, 2005), which enables a customer to customize a product by choosing the materials that constitute the product. The build-to-order model is appropriate when the customers attach substantial value to ownership of a customized product, such as mobile, hand-held or wearable computing and communication devices, clothing and jewelry, automobiles, etc. For certain kinds of products, the build-to-order model depends strongly on standardized interfaces that allow the assembly of products from components and the substitution of one component for another.

Supply chains are profoundly challenged by the new business and technology environment (ComputerWorld, 2006). A supply chain moves products or services from the suppliers to the customers. It involves suppliers providing raw materials or services, manufacturers assembling components into products, warehouses storing raw materials and manufactured goods, distributors providing finished products or services to customers, and customers purchasing products and services.

The main objective of supply chain management is to achieve the most efficient use of resources to meet the needs of the customers (Wikipedia, 2008). Among the highest costs incurred by the manufacturers are inventory carrying costs and logistics administration costs (Wilson, 2005). The just-in-time manufacturing model aims to reduce those costs, by manufacturing products on-demand and reducing the physical inventory in warehouses, resulting in a more efficient supply chain. Supply chain management deals with three types of flow:

- **Information flow**: Pertains to placing, transmitting and filling orders, and updating their delivery status
- **Product flow**: Involves movement of goods from a supplier to a customer, as well as customer returns
- **Financial flow**: Relates to credit terms, payments, payment schedules, consignment, and title ownership.

The MIDAS (Managing Integrated Demand and Supply) system that we have developed focuses on information flow. It provides a dynamic environment for customers, manufacturers, and suppliers to cooperate as they have never done before. The MIDAS system in one enterprise interacts with the MIDAS system in other enterprises dynamically over the Internet. MIDAS supports communication between manufacturers and suppliers, even if the manufacturer did not have any prior business with those suppliers and, thus, it increases the ease of collaboration between them. MIDAS makes it easier for small suppliers to get into business with large manufacturers by automating the procurement process. Most importantly, MIDAS aims to meet the needs of the customers on time, and to reduce the costs of the manufacturer by eliminating the need for a large inventory.

At the manufacturer, MIDAS receives orders from the customer, and places orders with the suppliers, automatically and dynamically. MIDAS allows a manufacturer and the suppliers to negotiate a business deal on-line either by accepting a quote as is, or by negotiating. MIDAS allows the manufacturer to use one of several strategies to aggregate customers’ orders before processing them, and one of several strategies to accumulate suppliers’ quotes before deciding on a particular supplier. This paper presents an evaluation of these strategies in terms of the customer’s satisfaction, as measured by the customer response time, and the manufacturer’s gain, as measured by the number of orders aggregated or the best price ratio.
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