Chapter 2
Industrial Supply Chain Coordination Based on Real-Time Web Service

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ABSTRACT

Integrating and coordinating supply chain business operations using intelligent wireless web (IWW) technology has been appreciated in many industries. In the IWW operational environment, real-time business process data collection using the internet of things (IoT) technology, web service, and artificial intelligence (AI) techniques play an enormous role in practical deployment purposes. This chapter explains how the IWW services and capabilities can be deployed in real-time coordination in supply chain management, and the feasibility of semantic technology has been depicted with the help of a business scenario. This chapter presents the main concepts of ontology-based semantic web service architecture for interconnecting distributed business operations in supply chain management. An ontology-based Semantic Web service discovery architecture (SWSDA) for the industrial supply chain is described as a business case. The concept of description logic (DL) and a service concept similarity assessment based on an algorithm are presented in this chapter.

INTRODUCTION

Today's business appreciates the value and consequence of building an effective supply chain as part of organizational proliferation and profitability (Pal, 2018). A supply chain is a network of facilities and distribution options that performs material procurement functions, transforming these materials into intermediate and finished products and distributing these finished products to customers (Ganeshan & Harrison, 1995). A research group introduces the concept of supply chain by defining it as integrating key business processes from end users through original suppliers that provide products, services, and information that add value for customers and other stakeholders (Liu et al., 2005). Supply Chain Manage-

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ment's main objective is effectively integrating the information and material flows within the demand and supply process. In other words, supply chain management (SCM) aims to improve logistical resource allocation, management, and control. In this way, it provides the potential for improved productivity, cost reduction, and efficient customer service (Pal, 2019). In addition, the benefits of SCM are based on effectively employing the right processes and supporting information and communication technologies.

With its origins in manufacturing, SCM relies on business operations to achieve a competitive advantage (Vrijhoef & Koskela, 1999). The first signs of SCM were perceptible in Toyota Motor Manufacturing's Just-In-Time (JIT) procurement system (Shingo, 1988). Mainly, JIT was used to control supplies to the factory just in the right quantities, to the correct location, and at the right time in order to optimize system-wide costs and customer affordability. The main goal was to drastically reduce inventory levels and regulate the suppliers' interaction with the production line more effectively. It consists of material and information flowing through the supply chain organizations. The scope of the supply chain begins with the source of supply and ends at the point of consumption. It extends much further than simply a concern with the physical movement of material. Equal emphasis is given to supplier management, purchasing, material management, manufacturing management, facilities planning, customer service, information flow, transport, and physical distribution.

Supply chain management tries to bring suppliers and customers together in one concurrent business process. Its main objective is to synchronize the customer's needs with the flow of raw materials from purchasers. It balances the constraint satisfaction problem (CSP) with reasonable customer service, minimum inventory holding cost, and optimal unit cost. In this complex CSP environment, the design and operation of an effective supply chain is of fundamental importance. It is also worth noting that the purchasing process does not finish when the customer orders using an existing sales channel. Customers' queries, before or after order placement, are inevitable. At the same time, the seller might want to contact customers with purchase confirmation and shipping information. Customer service encompasses all points of contact between the seller and the customer and is an essential output of SCM. It results from the accumulated value of all business processes along the supply chain. These business processes are responsible for offering an acceptable level of customer service. Moreover, these business processes are also interdependent; if one business function fails to provide the expected level of customer service, the chain is disrupted, and the scheduled workload in other areas is destabilized. Customer satisfaction is the casualty.

In order to provide better customer service at no additional cost or workload, all business processes along the supply chain have to be balanced. It requires trade-offs throughout the supply chain. When considering practical trade-offs, thinking of a single interconnected chain rather than narrow functional business processes is essential. Seamless integration along the supply chain is challenged when there is a conflict between a company's functional behaviours and objectives, as is often the case. For example, suppliers typically want manufacturers to purchase in bulk quantities, in stable volumes, and with flexible delivery dates. However, although most manufacturers desire long production shifts, they must be flexible to their customers' requirements and fluctuating market demands. Thus, the suppliers' objectives directly contradict the manufacturers' wish for flexibility. Indeed, since manufacturing decisions are typically made without accurate information about customer demand, the ability of manufacturers to match supply and demand depends mainly on their ability to change supply volume as information about demand arrives. In the same way, the manufacturers' goal of making bulk production batches typically conflicts with the objectives of distribution and warehouse facility layouts to reduce materials