


Chapter 5

A Semantic Web–Based Systems Integration to Enhance the Quality of Supply Chain Management

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ABSTRACT

Recent Semantic Web Technology developments indicate possible advancements in supply chain management. In particular, the innovative business process automation based on SWT attracted much interest from the logistics, manufacturing, packing, and transportation industries. This technology combines a set of new mechanisms with grounded knowledge representation techniques to address the needs of formal information modelling and reasoning for web-based services. This chapter provides a high-level summary of SWT to help better understand this technology's impact on broader enterprise information architectures. In many cases, it also reuses familiar concepts with a new twist. For example, “ontologies” for “data dictionaries” and “semantic model” for “data model.” This chapter presents the usefulness of a proposed architecture by applying theory to integrating data from multiple heterogeneous sources, which entails dealing with semantic mapping between source schema and Resource Description Framework (RDF) ontology, which are described declaratively using a specific query language (i.e., SPARQL) queries. Finally, the semantics of query rewriting are further discussed, and a query rewriting algorithm is presented.

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INTRODUCTION

Today's supply chain business appreciates the value and consequence of building an effective supply chain as part of enterprise proliferation and profitability. There exist different types of industry-specific supply chains (e.g., automotive, pharmaceutical, apparel, agriculture). In simple, the supply chain is a system with organization, people, technology, activity, information, and resources to deliver a product or service from suppliers to customers. Supply chain activity transforms natural resources, raw materials, and components into final products, and delivers them to customers. A network comprises the enterprises and enterprise departments involved in this process. The most important requirements of supply chain operation are minimizing the inventory and creating seamless material and information flow; effective communication must exist among the market, sale, purchase, supply chain plan, and control, appropriate customer delivery service, after-sales service, and so on. Therefore, 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 (Pal, 2017). Supply Chain Management (SCM) aims to improve logistical resource allocation, management, and control. In this way, supply chain SCM is a set of synchronized activities for integrating suppliers, manufacturers, transporters, and efficient customer service so that the right product or service is delivered in the right quantities, at the right time, to the right places. The ultimate objective of SCM is to achieve sustainable competitive advantage (Pal, 2019).

The first signs of SCM were perceptible in Toyota Motor Supply chain's Just-In-Time (JIT) procurement system. Particularly, JIT was used to control suppliers to the factory just in the right quantities, to the right location, and at the right time, in order to optimize system-wide costs and customer affordability. The main goal was to reduce inventory level drastically, and to regulate the suppliers' interaction with the production line more effectively. It consisted of two distinct flows through the supply chain organizations: material and information. 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 materials. Equal emphasis is given to supplier management, purchasing, inventory-management, supply chain management, facilities planning, customer service, information flow, transport and physical distribution. Some of the important business processes, along supply chain, are shown in Figure 1.

The ultimate objective with the implementation of SCM, suppliers and customers are viewed as partners and their relationship becomes a cooperative one as enterprises in the supply chain recognize that coordination among partners within the supply chain is a key factor of success. In order to operate a supply chain efficiently in a

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