

Chapter VII

SCOntology: A Formal Approach toward a Unified and Integrated View of the Supply Chain

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ABSTRACT

This contribution points out the various challenges associated to Supply Chain Management (SCM). SCM involves coordinating and integrating material, information and money flows, both within and across several companies. The integration of these flows is perceived in quite distinct ways by different communities, raising some semantics-related problems. To assist organizations in achieving a unified view of the Supply Chain (SC), a new ontology, named SCOntology, is introduced in this chapter. SCOntology is a framework to formally describe a SC at various abstraction levels, by sharing a precise meaning of the information exchanged during communication among the many stakeholders involved in the SC. Moreover, SCOntology provides a foundation for the specification of information logistics processes and also sets the grounds for measuring and evaluating a SC by stating different metrics and performance-related concepts.

INTRODUCTION

Nowadays, industrial SCs, involving manufacturers, suppliers, retailers and distributors, are striving to boost efficiency and responsiveness. In the face of highly competitive and global markets, there are big pressures to reduce lead times, minimize logistic costs and improve customer service by increasing agility, flexibility and responsiveness. Within this complex context, enterprises consider SCM to be a key area where improvements in the previous issues actually can be made. Thus, SCM is becoming the next frontier in organizational excellence. Among other reasons, new initiatives recognize the substantial cost reductions that can be achieved by improving logistics performance. In Europe, logistics costs range from 6% to 15% of total turnover (AT Kearney, 1993). In the United States, American companies spent \$670 billion on logistics and SC-related activities in 1993, corresponding to 10.5% of the Gross Domestic Product (GDP) (Akkermans, Bogerd, Yücesan, & van Wassenhove, 2003). In addition to the previous economic challenges, the Internet and e-business have created new competitive dimensions and add new challenges to SCM. Levi, Wu and Yen (2004) have pointed out that e-business might be viewed as the emergence of new economic intermediaries that offer new opportunities for innovation. Such intermediaries provide different means to respond to market demands, to facilitate procurement and to develop new mechanisms for coordination and execution. However, these new coordination mechanisms have not been developed yet.

The SC is a quite complex network that is very difficult to design and operate. Indeed, it covers the flows of material, information and money across a series of interplaying enterprises, encompassing suppliers' suppliers and customers' customers. This definition covers the so-called "extended" supply chain (ESC) as opposed to a company-centric view of the SC, where the SC is seen as consisting of the enterprise in question

as a central entity, possibly together with some peripheral partners, typically first-tier suppliers and customers (Lambert & Cooper, 2000). The era of when the focus was on managing the SC of a single company is clearly over. Management of both the ESC and the company-centric SC has been regarded areas of great interest in the last decade. In fact, different industrial and academic communities (software, industrial and process systems engineers, logistics professionals, etc.) are very active in addressing the SCM problem. For instance, according to the Council of Supply Chain Management Professionals (CSCMP, 2005), SCM encompasses the planning and management of all activities involved in sourcing and procurement, conversion and all logistics management activities. It also includes coordination and collaboration with channel partners, which can be suppliers, intermediates, third-party service providers and customers. In essence, SCM is an integrating function with primary responsibility for linking major business processes within and across companies into a cohesive and high-performing business model. However, there are several interpretations of SCM; for instance, Handfield and Nichols (1999) indicate that SCM encompasses all activities associated with the flow and transformation of goods from the raw materials stage (extraction, crop, etc.) to the end user, as well as the associated information flow, proving an operational view that emphasizes material flows. In fact, it is this logistics view that prevailed during the last decade. However, no one denies that nowadays a more global and integrated view of the SC is required.

Given the inherent complexity of the SC, the multiplicity of actors involved in it, as well as the variety of flows associated with it, several scientific and practitioner communities have attempted to make improvements in the SCM. However, challenges to be addressed are generally seen from a partial perspective. For instance, the Process Systems Engineering (PSE) community (Shah, 2005) has identified three main categories of

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