

Chapter XIII

Agents and Multi-Agent Systems in Supply Chain Management: An Overview

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ABSTRACT

This chapter discusses the current state-of-the-art of agents and multi-agent systems (MAS) in supply chain management (SCM). Following a general description of SCM and the challenges it is currently faced with, we present MAS as a possible solution to these challenges. We argue that an application involving multiple autonomous actors, such as SCM, can best be served by a software paradigm that relies on multiple independent software entities, like agents. The most significant current trends in this area are shown, focusing on potential areas of further research. Furthermore, the authors believe that a clearer view on the current state-of-the-art and future extension will help researchers improve existing standards and solve remaining issues, eventually helping MAS-based SCM systems to replace legacy ERP software, but also give a boost on both areas of research separately.

INTRODUCTION

This chapter discusses the current state-of-the-art of agents and multi-agent systems in supply chain management (SCM). The growing complexity of the supply chain has increased the need for effective supply chain management, which may raise profit and reduce stock at a minimal

cost. However, SCM is a complex problem of distributed nature and it often involves sensitive data that companies may be reluctant to reveal. Multi-agent systems (MAS) appear to be an ideal solution to this problem, as they can handle complex and distributed processes in an effective way. Considerable ongoing research efforts on MAS have yielded a wide variety of prototypes

and applications although the adoption of agents by the software industry proceeds at a cautious pace. Agent-based solutions for the SCM problem abound in the literature underlining the significant interest in this approach and its huge potential.

Section 1 provides a general description of SCM and explains the reasons that make effective SCM critical, both within a single company and across the chain. Section 2 discusses the main problems that SCM is currently faced with and section 3 explains the reasons why MAS are an ideal solution to this problem. Section 4 describes the various approaches and current trends and focuses on current problems that arise and areas that need further research. Finally, section 5 presents the main conclusions.

Current Trends in SCM

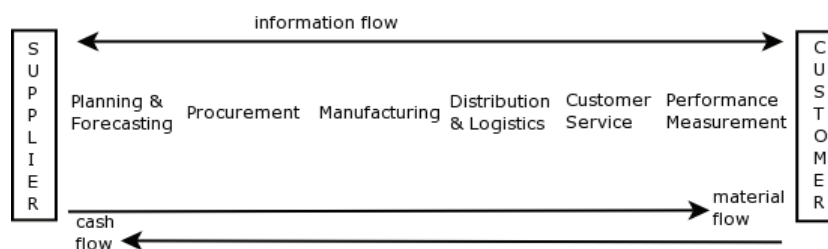
According to Stanfield (2002), “supply chain management deals with the management of materials, information and finance in a network consisting of suppliers, manufacturers, distributors and customers” (p.11). Practically, according to Kim, Tannock, Byrne, Farr, Cao, and Er (2004), “the activities involved in the material flow are to deliver to the end-user via procurement of raw materials, manufacturing, distribution and customer service” (p.10). All these activities must be managed using suitable information flows. This is easily illustrated in Figure 1.

The above factors cause increasing emphasis to be placed on integrating, optimizing and managing the entire supply chain from component sourcing, through production, inventory management and distribution to final customer delivery. Recent technological advances have facilitated this job, replacing approximate estimations by human experts by more precise calculations, as managing the supply chain is a complex task with increased sensitivity on small changes.

Increasing competition has emphasized the need for more flexible, robust and powerful supply chain management. The current trend in production is changing “from mass-production to customisation, and from technology and product-driven to market and customer-driven” (Kim et al., 2004, p.9). Bielli and Mecoli (2005) state that “current scenario in production and logistics fields must accomodate globalization, needs for increasing quality of goods, rapid changing in market demand, customer-service policies, flexibility of production processes, e-business and e-commerce” (p.147).

Many companies see the need for complete visibility into their supply chain as the starting point for managing them and many solutions are already implemented in this area. The next stage is to go further and implement solutions that are designed to change business practices and make supply chains more efficient.

Figure 1. Flows in the supply chain (Adapted from Speckman, Kamauff, & Myhr, 1998)



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