

## Chapter 2.17

# An Approach of Decision-Making Support Based on Collaborative Agents for Unexpected Rush Orders Management

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### ABSTRACT

Decisions at different levels of the supply chain can no longer be considered independently, since they may influence profitability throughout the supply chain. This paper focuses on the interest of multi-agent paradigm for the collaborative coordination in global distribution supply chain. Multi-agent computational environments are

suitable for a broad class of coordination and negotiation issues involving multiple autonomous or semiautonomous problem solving contexts. An agent-based distributed architecture is proposed for better management of rush unexpected orders. This paper proposes a first architecture validated by a real and industrial case. [Article copies are available for purchase from InfoSci-on-Demand.com]

## INTRODUCTION

The Supply Chain (SC) is increasingly interest for many business enterprises and a challenge for logistics management in the 21st century. Supply chain is defined as the chain linking each entity of the manufacturing and supply process from raw materials through to the end user (New and Payne, 1995). A supply chain comprises many systems, including various manufacturing, storage, transportation, and retail systems (Han et al., 2002). Supply Chain Management (SCM) has commanded attention and support from the industrial community. It consists in the coordination of production, inventory, location, and transportation among the participants in a supply chain to achieve the best mix of responsiveness and efficiency for the market being served (Hugos, 2003). The optimal deployment of inventory is one of the principal goals of SCM. Indeed, Many collaborative processes (e.g. CPFR: Collaborative Planning, Forecasting and Replenishment (VICS Association, 2007), VMI: Vendor Managed Inventory (John Taras CPIM, 2007), CRP: Continuous Replenishment Program and ECR: Efficient Consumer Response (ECR, 2006) and software systems (e.g. APS: Advanced Planning Systems (Simchi-Levi et al., 2000), ERP: Enterprise Resource Planning (Baglin et al., 2001) are used for management and control of inventory in order to reduce the total system cost of inventory as much as possible while still maintaining the service levels that customers require. Literature shows that the common objectives of these practices is to avoid the surplus inventory, reduce the inventory shortage, minimize the safety stock, produce and deliver products in the right quantities and at the right time. However for the distributor centers, it is difficult to achieve this goal, because the rush unexpected orders placed by the wholesalers always present a challenge. This challenge will vary from one company to another and from one supply chain to another. In fact, the distributor can not predict the date and the ordered quantity

of this type of orders since it is a random one whose causes are multiple and depend closely on the branch of industry. In addition, this type of orders has a very short delivery date. In this emergency case, the distributor is not able to wait for the next planned delivery of products from the supplier. Therefore, generally the order can be cancelled or can cause an inventory shortage if the ordered quantity is large. This will have a bad impact on the quality of the offered service within the satisfaction of the final customer policy.

Some suppliers allocate an additional human resources and logistics for delivering the rush unexpected orders of their distributors. The disadvantage of this solution is that the costs suggested are generally very high.

In multi-echelon networks, which is a common distribution model for many distributors and manufacturers, the distributors can deliver the rush unexpected orders. The echelon inventory includes the sum of local stock and the stock of all the forward distribution centers (Siala et al., 2006). However, multi-echelon inventory management is more coherent to the centralized decisions and it requires that all locations must be submitted to the relevant control of a single enterprise. In addition, it requires a high degree of information sharing between the various actors of the SC, but if the supply chain consists in independent enterprises, information sharing becomes a critical obstacle, since each independent actor is typically not willing to share with the other nodes its own strategic data (as inventory levels). Also, it monitors his inventory levels (by using autonomous action and policies) and places the orders to its suppliers in order to optimize its own objective (Siala et al., 2006).

This paper focuses on unexpected swings in demand and on unexpected exceptions (problem of production, problem of transportation, etc.), which are important coordination and communication issues in SC management (Giannoccaro et al., 2003) (Zhao et al., 2002). Both events can engender the presence of a rush unexpected orders in a node of

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