ABSTRACT

The key part of dynamic supply chain management is negotiating with suppliers and with buyers. Designing efficient business processes throughout the supply chain, and controlling their speed, timing, and interaction with one another, is decisive factors in a competitive and dynamic environment. Coordination is essential for successful supply chain management. Therefore, in this chapter, a novel Negotiation-to-Coordinate (N2C) mechanism is proposed to explore the interactive nature of the buyer-supplier relationships for dynamic environments. The proposed N2C mechanism uses prioritized fuzzy constraints to represent trade-offs among the different probable values associated with the negotiation issues and to signify how agents should make concessions. Supervisor agent in the N2C mechanism takes into account the conflicts of interest of buyer’s agent and supplier’s agent and the proposal and plan generated by supervisor agents helps in resolving the true and potential conflicts of interests for buyer’s agent and supplier’s agent. The proposed computational framework based on fuzzy constraints is suited for capturing the dynamics by modeling trade-offs between different attributes of a product leading to a fair and equitable deal for both suppliers and buyers. The proposed approach models the intricacies in the face of the imprecise, uncertain and conflicting nature of objectives. The efficacy of the proposed approach is demonstrated through an illustrative example.
INTRODUCTION

Traditionally, marketing, distribution, planning, manufacturing, and the purchasing of organizations along the supply chain operate independently. These organizations have their own objectives and they are often conflicting. Marketing’s objectives of high customer service and maximum sales dollars conflict with the manufacturing and distribution goals. Many manufacturing operations are designed to maximize throughput and lower costs with little consideration for the impact on inventory levels and distribution capabilities. Purchasing contracts are often negotiated with very little information beyond historical buying patterns. The result of these factors is that there is not a single, integrated plan for the organization. *Clearly, there is a need for a mechanism through which these different functions can be integrated together.* Supply chain management is a strategy through which such an integration can be achieved. Supply chain management is typically viewed to lie between fully vertically integrated firms, where the entire material flow is owned by a single firm, and where each channel member operates independently. Therefore, coordination between the various players to the chain is key in its effective management (Jain *et al.* 2007).

Supply chains are complex operations and their analysis requires a carefully defined approach. Most of previous studies have neglected significant impacts of integration issues because of the modeling complexity required. Therefore, past models may be confined in their capability and applicability to analyze real supply chain process. An integrated quantitative model, addressing the above-mentioned issues becomes an imperative (Jain 2006). Moreover, with the increase in technological complexity, supply chains have become more dynamic and complex to solve. Consequently, it is easy to get lost in details and spend a large amount of effort for analyzing the supply chain. *There is growing interest from industry and academic disciplines regarding coordination in supply chains, particularly addressing the potential coordination mechanisms available to eliminate sub-optimization within supply chains* (Fung and Chen 2005, Jain 2006). Coordination, the process by which an agent reasons about its local actions and the actions of others to try to ensure the community acts in a coherent manner (Toledo and Jennings 2002), is an important issue in multi-agent systems. There are three main reasons why it is necessary for agents to coordinate. First, there are dependencies between agents’ tasks or goals; second, there is a need to meet global constraints such as cost and time limits; and third, no individual agent has sufficient competence, resources, or information to solve the entire problem (Toledo and Jennings 2002).

Member enterprises in the chain need to cooperate with their business partners in order to meet customers’ needs and to maximize their profit. *Managing multi-party collaboration in a supply chain, however, is a very difficult task because there are so many parties involved in the supply chain operation, each with its own resources and objectives.* There is no single authority over all the chain members. Cooperation is through negotiation rather than central management and control. The interdependence of multistage processes also requires real-time cooperation in operation and decision-making across different tasks, functional areas, and organizational boundaries in order to deal with problems and uncertainties. *The strategic shift of focus for mass customization, quick response, and high quality service cannot be achieved without more sophisticated cooperation and dynamic formation of supply chains* (Chan *et al.* 2004). One solution to this problem is to have intelligent interacting entities, which can provide domain-specific information to validate the decision-making system. Therefore, Multi-agent system (MAS) based approaches for supply chain modeling are proposed (Swaminathan *et al.* 1998, Ertogral and Wu 2000, Julka *et al.* 2002, Jain *et al.* 2007 etc ).
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