Supply Chain Optimization, Management and Integration:

Emerging Applications

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terms of the types of risks, the unit of analysis, the industry sectors, and the risk management process or strategies addressed. The literature review will provide the basis for outlining future research opportunities in this field.

Chapter 3

This chapter presents dynamic analysis of a model of a centralised supply chain. The research was conducted within the manufacturing sector and involved the breathing equipment manufacturer Draeger Safety, UK A simplified model of the Draeger Safety, UK centralised supply chain is developed and validated. Simulation and analysis are performed using System Dynamics, control theory, nonlinear dynamic and chaos theory. The findings suggest that destructive oscillations of inventory could be generated by internal decision making practices. Bifurcation diagram is plotted to indicate the bifurcation status of the model with different internal decision policies. A management microworlds is developed for managers to experiment with different decision scenarios and learn how the supply chain performs.

Chapter 4

Recognizing radio frequency identification (RFID) as a disruptive technology unearths interesting facts that could help managers decide how to approach their RFID projects. RFID for the supply chain (RFID/SC) has attracted global attention and many firms are already using RFID in their business processes. It was found that the uptake of RFID in New Zealand supply chains has been slow. Following on our previous work that used the motivation/ability framework to describe RFID/SC, this paper looks at the motivation and ability of New Zealand supply chains to explain the slow adoption rate. Case studies are used to illustrate the principles of the motivation/ability framework. The objectives of this paper are: (1) to equip managers with the knowledge of disruptive technology in the context of RFID/SC, (2) to highlight the need to assess an organization's motivation and ability for adopting RFID/SC, and (3) to propose actions industry can take in the adoption of RFID/SC.

Chapter 5

Supplier selection is a multiple criteria decision making problem that the selection process mainly involves evaluating a number of suppliers according to a set of common criteria for selecting suppliers to meet business needs. Suppliers usually offer volume discounts to encourage the buyers to order more. To select suppliers in the presence of both volume discounts and imprecise data, this chapter proposes an optimization method. A numerical example demonstrates the application of the proposed method.

Supply Chain Management (SCM) has proven to be an effective tool that aids companies in the development of competitive advantages. SCM Systems are relied on to manage warehouses, transportation, trade logistics and various other issues concerning the coordinated movement of products and services from suppliers to customers. Although in today's fast paced business environment, numerous supply chain solution tools are readily available to companies, choosing the right SCM software is not an easy task. The complexity of SCM systems creates a multifaceted issue when selecting the right software, particularly in light of the speed at which technology evolves. In this chapter, we use the approach of Analytic Hierarchy Process (AHP) to determine which SCM software best meets the needs of a company. The AHP approach outlined in this paper can be easily transferred to the comparison of other SCM software packages.

Section 2

Supply chain performance is highly influenced by the coordination level between its members, which needs information sharing. In this paper we consider a three-echelon direct sell supply chain model and focus on the problem of coordinated decision-making between its members. Our contribution is a first approach that measures the impact of the degree of coordination between the members. Demand behavior is modeled using a geometric Brownian process. Simulation models are run in order to analyze various cooperation scenarios. Our results show a direct relation between the degree of coordination within the supply chain and the total system cost. Although this result is intuitive, our simulations allowed us to quantify such a relation and in which measure these costs are whether or not associated to imperfect coordination.

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.

In this chapter it is analyzed the importance of contracts for coordination between two companies in a supply chain. In the studied situation, one company, or supplier, supplies one product to the other company, who is a retailer. The companies are going to coordinate by two types of decisions: economic (concerning prices fixed on a contract), and physical exchange (concerning the inventory to be held). Two types of contracts will be presented: one contract with a simple pricing scheme and two contracts with inventory holding cost shared among the companies of the supply chain. The objective is to show that contracts with inventory holding cost share allow the two companies to efficiently coordinate the chain they form.

Nowadays, implementing collaboration strategies between the members of the supply chain has been an important research topic to obtain a more reactive and flexible supply chain in the highly competitive markets. However, few studies have been done on the impact of such collaboration strategies at one of the lower short-term decision levels: production scheduling. This paper is devoted to the study of information sharing between the members of a supply chain in a dynamic context. We consider a typical make-to-order direct sell supply chain without finished products inventory, similar to the one implemented by Internet PC sellers. We compare various scheduling algorithms implemented to study different scenarios of information sharing among the members of the chain. We have considered scenarios where no information is shared and scenarios where some or all information is shared. A simulation study is developed in order to get some insights about the impact of information sharing on the performance of the chain. Our results suggest improvement in the performance that shows the importance of collaboration and information sharing between the members of the chain.

The effective coordination is a key element in the success of many cooperative supply chains. All production, distribution and supply must be adequately synchronized in order to satisfy the customer needs and at the same time optimizing the operational costs. This paper presents a multi-product, multi-echelon inventory system which comprises one manufacturer, a number of distribution centers and a number of retailers which are dependent of such distribution centers. The coordination and collaboration is achieved through a carefully designed replenishment policy. The near-optimal order quantities for each of the supply chain agents are calculated with a mathematical model in which the integrality constraints are relaxed. A number of instances were generated and tested. The results show the validity of the proposed approach.

Section 3

Chapter 12

In recent years, simulation optimization has attracted a great deal of attention because simulation can model the real systems in fidelity and capture complex dynamics. Among numerous simulation optimization algorithms, Simultaneous Perturbation Stochastic Approximation, SPSA algorithm is an attractive approach because of its simplicity and efficiency. Although SPSA has been applied in several problems, it does not converge for some. This research proposes Augmented Simultaneous Perturbation Stochastic Approximation, ASPSA algorithm in which SPSA is augmented to include research, ordinal optimization, non-uniform gain, and line search. Performances of ASPSA are tested on complex discrete supply chain inventory optimization problems. The tests results show that ASPSA not only achieves speed up, but also improves solution quality and converges faster than SPSA. Experiments also show that ASPSA is comparable to Genetic Algorithms in solution quality, 6% to 15% worse but is much more efficient computationally, over 12x faster.

Chapter 13

Information risk management is crucial for an organization operating in an increasingly integrated and intensively communicated environment to mitigate risks and ensure core business functions. Given the open and dynamic nature of a supply chain network, information risk management is challenging and various factors must be considered. This chapter introduces a trust-based approach to facilitate supply chain participants to perform effective risk management. The major components of the proposed framework include supply chain member trust evaluation, data classification, and trust-based decision making. The major purpose of the framework is to control and mitigate information risks that a participant faces in a supply chain network, e.g., risks to information confidentiality, privacy, and integrity. We apply the principle of transitive trust for trust evaluation and use several decision tools for risk analysis and mitigation.

Supply chains operate under conditions of uncertainty, and chain members exchange information as a means to mitigate such uncertainty within the chain. While these exchanges have largely been viewed as a positive method of achieving operational cohesion, some supply chains appear to benefit more from increased levels of information sharing than others. To assist in explaining the performance differences experienced by supply chains engaged in information-sharing activities, a new perspective of information sharing within supply chains based on organizational information processing theory (Galbraith, 1973) is introduced. More specifically, it is posited that individual supply chains may be examined as single information processors and that their characteristics can induce complexities in the shared information—ultimately an issue that affects how supply chains process this information. Furthermore, the degree to which supply-chain members' information systems are compatible with each other is posited to also play a significant role in information-processing capabilities.

Chapter 17

This chapter explores the issue of lead-time in response-based supply chains. From a tactical viewpoint of response-based supply chains, the processing time for each stage is assumed to be a random variable since different practices exist in the selection pool of each stage under a specific lead-time requirement. The decision-maker must select suitable practices of operations for each stage to ensure that the lead time meets a desired requirement. The relationship and the trade-off between the operating costs for the selected practices and the inventory holding cost of safety stock that is in turn affected by the lead-time are discussed. A mathematical model for planning the operations from a manufacturer viewpoint is proposed. The variation in practical situation for the proposed model is also addressed. A hypothetic example is provided to illustrate the effectiveness of the proposed model. With reference to the computational results, the effect of several parameters on the model's optimal solutions was discussed.

Section 4

Chapter 18

In this chapter we focus on examining the coordination mechanisms for a two-stage supply chain comprising one supplier and one retailer. We consider such a channel relationship that the transaction quantity between the two members is sensitive to the supplier's inventory level and that the supplier's unit inventory holding cost has a linear stepwise structure. We devise a coordinated revenue-sharing contract with bargaining so that each party's respective profit is better than that resulted from the simple sequential optimization mechanism. The key contract parameters, namely the supplier's inventory level and the retailer's revenue-sharing fraction, are obtained and analyzed. Numerical illustrations of the

contracts are given and shed lights on how the supply chain should coordinate in order to gain better performance.

Chapter 19

In many multi-stage manufacturing supply chains, transportation related costs are a significant portion of final product costs. It is often crucial for successful decision making approaches in multi-stage manufacturing supply chains to explicitly account for non-linear transportation costs. In this chapter, we have explored this problem by considering a Two-Stage Production-Transportation, TSPT. A two-stage supply chain that faces a deterministic stream of external demands for a single product is considered. A finite supply of raw materials, and finite production at stage one has been assumed. Items are manufactured at stage one and transported to stage two, where the storage capacity of the warehouses is limited. Packaging is completed at stage two, that is, value is added to each item, but no new items are created, and the finished goods inventories are stored which is used to meet the final demand of customers. During each period, the optimized production levels in stage one, as well as transportation levels between stage one and stage two and routing structure from the production plant to warehouses and then to customers, must be determined. The authors consider "different cost structures," for both manufacturing and transportation. This TSPT model with capacity constraint at both stages is optimized using Genetic Algorithms, GA and the results obtained are compared with the results of other optimization techniques of complete enumeration, LINDO, and CPLEX.

Chapter 20

At the present time and with the economic orientation towards maturity, enterprises unlike the traditional competitive business strategies are wanted out of necessity to cooperate with other enterprises and to add new activities to their existing profiles. The rapid growth of technologies motivates enterprises to invest more and more in this domain with the adoption of the cooperative e-business applications. Consequently, we propose in this paper an approach that permits enterprises to enhance their cooperative activities. This approach is based on the agent and Web services paradigms. It is organized in the form of cooperative application groups representing the different parts of a company. Agent coordinators orchestrate the cooperative work of these groups. The most requested functionalities inside the enterprise and those offered to the external world can be exported as Web Services. We describe the Web Services with DAML-based Web Service ontology (OWL-S). The search, invocation and exploration of these Web services can be offered by an intermediate agent called Web Service Finder Agent. The proposed

approach provides a new vision of the cooperation context where the companies and their partners share knowledge and offer functionalities as agents and Web Services.

In this research work we are interested about connection between lead time performance, and production order size as well as in how many production lots this order was eventually produced. Based on the system dynamics simulation model, the authors got a priori assumption that production lots have in multiproduct environment better explanation power. Our empirical findings give support for this – number of production lots explain in production environment manufacturing lead time much better than production order size. Further support is gained from supply chain phases, which are analyzed similarly, but as surprise explanation power of production lots decreases, and seems to be significantly lower in more distant markets. It is interesting to note that currently used IT applications of analyzed global case company do not give real time snapshot regarding to the development of overall supply chain lead time.

Although many researchers have studied inventory models for perishable items, the situation of advance sales, spot sales and order cancellations have not been addressed so far. However, this problem arises in a variety of industries including the sales of fashion garments, flight seats and hotel rooms. In this chapter, we deal with an inventory system in which sales cycle is divided into an advance sales period and a spot sales period. We consider order cancellation effect which depends on the waiting time of the customer orders. The goal is to determine the optimal order quantity and optimal prices in order to maximize the profit. We also show the concavity of the profit function using mathematical lemmas and theorem. Besides we develop a solution procedure which computes optimal policy effectively. Finally we present the results of numerical study for linear and exponential demand functions.