Preface

e-Supply network (e-SN) is an electronic-based, dynamic, and distributed supply system comprised of many transactional and inter-connected echelons where the membership, the structure of interaction, and the nature of network attributes as represented by informational flow change dynamically over time. On the one hand, the advents of new information systems and technologies have created a better understanding of e-SN systems. On the other hand, the widespread diffusion of digital infrastructure, applications, products, and services have created new challenges and opportunities for managers and corporations exposed to the dense and highly complex supply networks. In order to deal with this complexity, innovative models, techniques, tools, processes, and structures are often required. An interesting development in the context of e-SN is exploiting the benefits offered by coordination mechanisms on functional relationship between the echelons of the network. Supply network coordination (SNC) emphasizes the cooperation among supply echelons, and realizes the dynamic nature of information, capital, and material flows with the assistance of electronic commerce and intermediary services. SNC benefits from a variety of concepts that are developed in several different disciplines of marketing, information systems, economics, system dynamics, logistics, operational management, and operations research.

The goal of this book is to present the cutting-edge knowledge on scientific approaches to the management of supply networks in a highly informed global environment faced with dynamic and uncertain challenges. Companies constantly adopting improved decision making practices can create unique advantages and enjoy sustainable competitiveness. Uncertainty is one of the most powerful forces shaping today’s business environment. As this environment unfolds, traditional approaches to manage supply chains are being transformed to coordinate supply networks and should be continuously improved. This book examines how new theories, mathematical and conceptual approaches are incorporated with information technology and intelligent systems and how the proposed models can help us improve the coordination of the considered networks.

The presenting material is organized in 3 parts comprising 15 chapters. A summary of each part and descriptions of the chapters are presented next.

SECTION 1 SUMMARY

Section 1 consists of five chapters dealing with the new concepts and advances of supply network coordination. Chapter 1 is concerned with appropriating the concept of supply chain into supply network. Chapters 2 and 4 discuss the concepts of e-business and RFID technology in supply network. Chapter 3 presents an integrated supply chain intelligence model and Chapter 5 investigates the adoption of ICT in supporting supply chain coordination for logistics services providers.
Chapter 1

Successful implementation of supply network requires an in depth knowledge of the related concepts and factors. Here, Cho appropriates the concept of supply chain into supply network including broader base of suppliers and partners connected physically and electronically. The scope and depth of management issues and research focuses have also extended from traditional supplier-buyer dyad and a linear list of suppliers to a collection of inter-related companies. The issue of coordination lies at the core of the management of supply network. Considering the importance and attractiveness of the issue, Cho presents fundamental concepts, issues, and perspectives corresponding to supply network coordination.

Chapter 2

E-business is concerned with the use of the Internet to link companies with their suppliers, customers and other trading partners. Supply chain management (SCM) is fundamentally concerned with integration of activities both within and among organisations. Information technology plays a crucial role in SCM as a key enabler of supply chain integration. In this chapter, Wagner and Sweeny set out the role of e-business concepts in the context of the supply chain challenges faced by firms through description and critical assessment of e-business developments impacting supply network integration strategies. The chapter explores the specific role of e-procurement as an example of how e-business concepts are applied to key SCM activities namely purchasing and procurement.

Chapter 3

Successful SCM is nowadays essential for the ultimate success of organizations. However, today’s supply chains are typically complex systems with silos of distributed data that is very difficult to integrate and analyze. The main reason is the lack of a methodological and process-oriented approach to system design, and the absence of robust and scalable architecture and tools that are essential for realizing the new initiative called Supply Chain Intelligence (SCI). In this chapter, Stefanovic et al. present the integrated SCI model, system architecture and the supplemental software solution based on web portals, web services and application composition. The presenting SCI model fuses all relevant elements such as people, business processes, metrics, KPIs and other analytical tools into a single comprehensive system. The introduced integrated SCI approach can help supply chain members to reveal opportunities, reduce costs, and improve performance. It also enables organizations to envision the entire supply chain from customer’s perspective.

Chapter 4

Grazia Gnoni and Rollo propose a content analysis of Radio Frequency Identification (RFID) applications in supply network management. RFID technology is currently an effective enabling technology for automatic identification and it could potentially improve supply network management by guaranteeing more visibility and real time communications across actors. RFID application is affected by some criticisms from both technological and economical points of view. The authors propose an effective analysis about the benefits and pitfalls regarding RFID application in different industrial contexts. The content analysis supplies information for developing an effective reference model to assess actual potentiality of RFID technology application in a specific context.
Chapter 5

In today’s turbulent supply chain environment characterized by ever-increasing customer demands for improved services at lower costs, third-party logistics service providers (3PLs) play a more critical role in coordinating and integrating multiple flows along supply chain. Accordingly, on the one hand the adoption of ICT is a key element in the strategy of modern logistics service companies and on the other hand, it is a great challenge, particularly for small 3PLs. In this chapter, Evangelista presents findings deriving from a questionnaire survey carried out on a sample of 153 small Italian 3PLs. The results are fully discussed shedding light on the technology adoption process in these companies as well as giving several implications for supply chain coordination.

SECTION 2 SUMMARY

Section 2 consists of five chapters on modeling and analysis of supply networks. Chapter 6 presents a comprehensive methodology to design a multi-echelon, multi-facility, and multi-product supply chain. Chapter 7 deals with the problem of Reverse Logistics Network Design. Chapter 8 presents a comprehensive web-based fuzzy order-delivery system in an electronic market. Chapter 9 models partnership network for an intelligent supply chain and chapter 10 analyzes the impact of price competition on supply chain coordination.

Chapter 6

Effective supply chain management requires novel methodologies to incorporate uncertainty in the modeling and selection of supply chains. One type of uncertainty considers fuzziness in the description of target values of the objectives, constraints, and input parameters. In this chapter, Rao and Subbaiah formulate a comprehensive and robust methodology for the design of a multi-echelon, multi-facility, and multi-product supply chain in an uncertain environment. The main aim of the chapter is to present a strategic fit between competitive strategy and supply chain strategy of a business organization. In addition, the authors consider stochastic lead times, interdependency of economic order quantity and reorder point, and fuzziness in the specification of objectives and constraints in the model formulation. The proposed methodology is illustrated by a numerical example.

Chapter 7

Due to the proliferation of environmental problems, environmental initiatives enforced by governments, customers or company themselves, have become mandatory. As part of environmentally conscious initiatives, reverse logistics have attracted considerable attention both from academicians and practitioners. Reverse logistics network design (RLND) is a key component of the reverse logistics’ current state of the art and its effectiveness has a serious impact on the effectiveness of the whole supply network coordination. These problems being NP-hard, Tuzkaya et al. investigate the RLND problem and propose a hybrid genetic algorithm and simulated annealing methodology. The authors signify some notions on the capability of the solution approaches for the proposed problem.
Chapter 8

This chapter considers supply chain as a network of suppliers, factories, warehouses, distribution centers and retailers where customer satisfaction is of prime concern. The authors propose a fuzzy electronic supply chain system with a logistic viewpoint. Fazlollahtabar et al. suggest a mathematical model for a supply chain composed of supplier, plant, and customer with the aim to optimize a real time web-based fuzzy order-delivery system. The effectiveness of the model is shown by working out a comprehensive numerical example.

Chapter 9

The development of manufactured products through the contribution of a series of specialized companies in a supply chain organization type generally leads to problems of responsiveness and bullwhip effect, mainly due to the static contractual relationships. This chapter considers a new supply chain approach discussing a dynamic allocation of tasks among companies in a partnership network, while allowing obtainment of a good load smoothing with optimal use of the more efficient resources. Ounnar et al. address the decision-making mechanisms of the approach giving a real intelligent character on the supply chain behaviour via the holonic paradigm and its isoarchic implementation by utilization of an interaction protocol and a multi-criteria decision-making method, AHP (Analytic Hierarchy Process). The approach is validated in a distributed simulation environment HLA (High Level Architecture).

Chapter 10

In this chapter, Sarmah and Sinha analyze the impact of price competition on supply chain coordination. The considered problem is that a vendor distributes a product to two different retailers competing over their retail prices in the same market. The demand faced by each retailer not only depends on the price itself, but also on the price set by the other retailer. The authors demonstrate that perfect channel coordination can be achieved by employing simultaneous quantity discounts, volume discounts, and franchise fees. In addition, it is shown that the process of price competition is dynamically stable in nature under certain conditions and also the system pay-off under decentralized setting and without coordination is considerably less than that obtained under centralized setting.

SECTION 3 SUMMARY

Section 3 consists of five chapters on utilization of intelligent agent technology to supply network coordination. Chapters 11 and 12 introduce new concepts and agent-based coordination mechanism for two echelons supply network. Chapter 13 deals with co-opetitive network and relevant agent-based coordination mechanisms. Chapter 14 proposes an appropriation of the federation interoperability concept for information exchange between networked enterprises such that the proposed approach combines the use of Multi Agent / HLA paradigm and the emerging concept of Short-Lived Ontology. Chapter 15 expands the echelons of the network and proposes a dynamic route selection procedure for an agent-based multilayer electronic supply network.
Chapter 11

Realizing the agility of e-supply network (e-SN), Mohebbi et al. introduce the concept of buyer-supplier-supplier triadic and propose an agent-based e-SN architecture and a coordination mechanism. This chapter considers the impact of suppliers’ coordination in a network where the coordination and negotiation among buyers and suppliers are in place. To propose an effective and practical coordination mechanism, the authors limit the cooperation among suppliers to those areas where no competitive conflicts exist. A multi-agent system is utilized to facilitate information sharing leading to an effective decision making while preventing the parties from accessing the undesired information. The efficiency of the proposed approach is evaluated using a simulation model and the obtained results are compared with those of buyer-supplier coordination.

Chapter 12

Realizing the positive effects of information sharing on e-supply network (e-SN) performance, Cho et al. consider buyer-buyer-supplier triadic where different small buyers are dependent on large suppliers. In order to achieve an executable model for implementation, in addition to defining a coordination mechanism and a search procedure, the authors utilize agent technology and propose a classification of network attributes and updating rules by fairly considering both suppliers and buyers. Indeed, agent technology facilitates information sharing, while not directly exposing some of this information to the tiers, and thereby assists buyers in finding most promising suppliers. In this chapter, the whole system follows service oriented architecture and a web interface for the system is presented. The proposed method is compared with a more traditional method using agent-based simulation.

Chapter 13

In recent years, manufacturing companies are faced with mounting competitions in a global economy. To stay competitive, companies must use production systems that not only produce the goods with high productivity, but also allow for rapid responses to market changes and customers’ needs. The emerging new paradigm of inter-firm relations involving both cooperative and competitive elements, called co-opetition, seems to face this issue well. In this chapter, Renna and Argoneto propose a multi-agent architecture to support different coordination policies in an electronic co-opetitive network in which plants are willing to exchange productive capacities. The authors first give an extensive literature review of co-opetitive concept and the recent research works. Then, an innovative approach based on cooperative game theory is proposed and its performance is compared with the prevalent negotiation approach. A discrete event simulation environment is developed in order to evaluate the related performances. Based on the obtained results, the authors conclude that the proposed approach outperforms the negotiation mechanism form several points of view. In particular, the game theory approach leads to better benefits for the network of plants in terms of increment of profit, homogenous distribution of profit among the plants and reduction of logistic complexity. The negotiation approach leads to better results for the customer point of view in terms of unsatisfied demand.
Chapter 14

Zacharewicz et al. propose a pioneer incorporation of the federation interoperability concept (according to ISO 14258) by specifying a platform for simulation and real execution of information exchange among networked enterprises. The proposed approach cleverly combines the use of Multi Agent / HLA paradigm and the emerging concept of Short-Lived Ontology, introduced by the authors. The authors give a detailed review of concepts and ongoing research in the domain of Enterprise Interoperability. Then, they recall the Artificial Agent Concept and the HLA Standard and point out their adequacy to support simulation and execution of the considered concept. Indeed, the authors state that, on the one hand, agent dialogue fits the concept of information exchange in a federated enterprise interoperability approach, and on the other hand, the HLA standard, initially designed for military M&S purpose, can be transposed for enterprise interoperability at the implementation level, reusing the years of experience in distributed systems. Based on these postulates, the authors propose the first Agent/HLA Short-Lived Ontology based development methodology to implement a distributed enterprise simulator of information system using the conceptual level of federated enterprise interoperability approach. They also explain a new algorithm using HLA functions to run the communication for information exchange in the new context.

Chapter 15

This chapter discusses a dynamic route selection in an agent based multilayer electronic supply network (e-SN). Mahdavi et al. develop an intelligent information system for a multilayer e-SN and propose a multi-agent system to analyze the performance of the elements of a supply network based on the attributes of the information flow. The proposed agents measure and record the performance flow of elements considering the web interactions for a dynamic route selection. The dynamic programming approach is utilized to determine the optimal route for a customer in the end-user layer. The proposed approach is illustrated by an example.

All chapters have gone through a rigorous, double-blind review process before acceptance. We believe that the book will be a comprehensive compilation of the thoughts and visions necessary for creating an effective e-SN. The presentations illustrate the concepts along with implementations and applications. They offer practical guidelines for the design, development, and implementation of an e-SN. The book is informatively beneficial to the undergraduate and graduate students taking supply chain management courses and to practitioners for supportive decision-making. Hopefully, the book will also stimulate new research on e-SNC.