Editorial

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Biographical notes: Zhenying Zhao is currently working as a Supply Chain Analyst in Customer Fulfilment and Planning Group, Intel Corporation. Before he joined Intel, he was an Associate Research Scientist in R.H. Smith School of Business at the University of Maryland College Park. His research interests are in the areas of mathematical modelling and optimisation, supply chain management, computer simulation, production and operations management and supply chain management systems and Enterprise Resource Planning (ERP) systems. He had worked with Intel, Toshiba, Maxtor and Compaq on business process improvement, Available-To-Promise (ATP) decision support and supply chain management. He received his PhD degree in Supply Chain Management from Nanyang Technological University, Singapore.

Chien-Yu Chen is currently an Assistant Professor of Operations Management in the School of Management. He received his PhD from the University of Maryland, College Park, in 2003. Chen's research interests are in applying management science models and methods to the areas of logistics, operations and supply chain management. He developed various Available-To-Promise (ATP) models for order-promising and order-fulfilment decision support. He is recently working on stochastic programming models and decomposition algorithms for solving ATP problems with order uncertainty. He has publications on journals, such as *Production and Operations Management*, *Information Systems Frontiers* and *Operations Research Letters*. He taught management science, operations management and business forecasting.

With the development of internet-enabled transactions and applications, supply chain management is undergoing dramatic changes. While real-time information becomes more accessible throughout a supply chain, globalisation makes supply chain operations more complicated and dynamic. To sustain competitive advantages, companies are now required to react quickly to any changes in a supply chain. Real-time optimisation and execution processes therefore surpass traditional supply chain planning functions in strategic importance, especially in an Assembly-To-Order (ATO) or Configure-To-Order (CTO) production environment. We foresee that optimisation-based real-time decision-making and decision support systems are the keys to unlocking new challenges in supply chain management. In this special issue, we are pleased to present six papers that cover a broad variety of subjects in real-time supply chain optimisation and execution. These papers discuss optimisation techniques, execution strategies, heuristic algorithms and empirical studies in different supply chain sectors.

Minis, Ampazis and Mamasis (2006) study a real-time management system for distributing goods to clustered clients in their paper, 'Efficient real-time management of goods distribution to clustered clients'. The authors proposed a near real-time and optimisation-based approach to re-planning a single vehicle route over a set of clients after the vehicle experiencing significant delays due to traffic congestion, dock unavailability or unloading slowdowns. The main objective in the re-planning is to minimise the adverse impact on delay by selecting the clients to be served and the clients to be deferred delivery. The authors formulate the problem as an Orienteering Problem (OP), a generalised Travelling Salesman Problem (TSP), whose objective function is to maximise the total collected prize over a set of geographical sites. To reduce computation complexity, the proposed approach decomposes the problem spatially into a number of smaller sub-problems according to the geographical distribution of clients cluster. Within each cluster, an established OP heuristic is used to determine the clients to be served and the corresponding vehicle route. The available vehicle time is distributed to each cluster by solving a non-linear optimisation problem. The proposed method has been verified with Tsiligirides' standard problem instances and with two large practical cases from food manufacturers. The results indicate that the proposed method outperforms conventional methods used to solve the monolithic problem in both solution quality and computation time. The proposed approach is thus suitable for real-time applications.

To deal with the unforeseen adverse delivery conditions in urban distribution, Zeimpekis, Tatarakis, Giaglis and Minis (2006) introduce a dynamic real-time vehicle management system developed in Greece in their paper, 'Towards a dynamic real-time vehicle management system for urban distribution'. Based on an empirical survey and in-depth interviews with logistics managers, the authors proposed a decision and information architecture for a dynamic real-time vehicle routing system. Such a real-time optimisation and execution system aims to dynamically adjust delivery schedule in ever-changing urban distribution environment. The architecture consists of Decision Support Module (DSM), Geographical Information Module (GIM), Data Management Module (DMM), Vehicle On-board System (VOS), Control Centre User Interface (CCUI) and Vehicle User Interface (VUI). With the six integrated modules, the dynamic real-time vehicle routing system can monitor the real-time execution of deliveries and provide optimisation-based re-routing recommendations when needed. Based on the detected deviations from the delivery schedule, the Decision Support Module classifies the situations into different well-known problem types and then applies appropriate vehicle routing techniques from the literature accordingly. The authors also discuss the practical implementation considerations in the integrations with existing Enterprise Resource Planning (ERP) systems, the choices of communication technologies and the options of vehicle on-board technologies. The proposed architecture for a dynamic real-time vehicle routing system is undergoing a prototype phase. The prototype will be tested in real-life operations in two Greek companies in order to validate the technical design and provide empirical evidence on the system's benefits.

Supply chain performance improvement can result from the effective elimination of non-value-adding wastes in material flows cross an entire supply chain. Effective information sharing is one of the key drivers to ensure efficient material flows in a complex supply chain network. In their paper, 'Streamlining information flow in steel product design and manufacturing industry network', Iskanius, Alaruikka and Page (2006) conduct two empirical case studies on the steel product industry network in the Northern Finland and propose agent-based information sharing systems for integrating distributed computing, mobility and inference in a complicated supply chain. The authors first give a comprehensive overview of supply chain management, and then discuss the importance of information sharing in supply chain coordination and introduce agent technology as a supply chain improvement solution. The new agent-based system emphasises simultaneous communication between different parties in order to enhance information transparency and to integrate supply chain operations over the entire supply chain as a whole. A prototype including two agents, a manufacturing coordinator agent and a corresponding company agent, is developed. While a coordinator agent takes care of manufacturing data storage and transmission, a company agent classifies the importance of certain manufacturing data and determines the necessity of notifying company personnel about the potential supply chain problems. The authors further discuss the ideas and potential benefits of using multiple intelligent agents in a supply chain to improve information transparency and operations efficiency.

To reduce the Bullwhip effect over a supply chain, Balan, Vrat and Kumar (2006) propose to replace a conventional P-controller with a fuzzy logic controller in their paper, 'Reducing the Bullwhip effect in a supply chain with fuzzy logic approach'. The authors illustrate that a conventional P-controller (similar to a typical periodical-review order-up-to-date inventory system) amplifies the magnitude ratio between the order amount placed to the upstream member and the order amount received from the downstream member in a three-echelon supply chain. The Bullwhip effect results from P-controller's incapability of considering and controlling the vagueness or ambiguity of order information. On the other hand, the proposed fuzzy logic controller can effectively smooth the vagueness of forecasted demand and order information across a supply chain so that the intensity of the Bullwhip effect can be reduced. A detailed fuzzy controller model, which contains fuzzification, defuzzification and inference blocks, together with a step-by-step solution procedure is discussed in the paper. Furthermore, the authors also introduce an artificial neural network tuning method, called Adaptive Neuro Fuzzy Inference System (ANFIS), to construct an input-output mapping base on both human knowledge and stipulated input-output data pairs. With ANFIS, the fuzzy logic controller does not need to pre-specify the parameters of membership functions; the parameters can be obtained from real data directly. The authors use a numerical example to show that further reduction of Bullwhip effect can be achieved with ANFIS.

In order to optimally match supply with demand over a complicated supply chain setting, Available-To-Promise (ATP) has become a critical business function. Robinson and Carlson (2006) present a Mixed-Integer Programming (MIP) model for supporting dynamic order promising decisions in their paper, 'Dynamic order promising: real-time ATP'. Both Make-To-Stock (MTS) and Make-To-Order (MTO) production activities coexist in the ATP system across a time horizon consisting of final assembly, module production and production scheduling phases. The MIP model considers real-time availability from five distinct sources, which include finished goods inventory, final assembly Work-In-Process (WIP) inventory, module production WIP inventory, production scheduling capability and remote sourcing availability. Upon each customer's arrival, the real-time ATP system executes the optimisation model to obtain an order-promising solution. While satisfying due date, resource availability and bill-of-materials constraints, the MIP model minimises the changes in inventory holding costs, production revenue and administration costs. The authors also conduct a series of simulation experiments by varying system and customer parameters to study the long-term effects of real-time ATP decisions on percentage of orders accepted and average cost per accepted unit. Simulation results indicate that the performance measures are most sensitive to capacity utilisation level. Some other factors, including demand variability, daily order volume and order size also have significant effects.

In their paper, 'Supply chain analytic capability: environment and performance', Iyer, Germain and Frankwick (2006) explore the factors affecting supply chain analytic capability. The authors refer supply chain analytic capability as the deployment of sophisticated information technology applications embedded in ERP and/or legacy systems. Such information and decision systems support decision-making at all strategic, planning and operational levels using advanced algorithms and heuristics. The research examined the relationship among supply chain analytic capability, firm's environment in the form of process turbulence and demand unpredictability and the firm's operations measured by logistical performance and operational stability. Followed by a pilot test, a full empirical survey was conducted to test the hypotheses embedded in the proposed structure equations. The results show that better analytic capability leads to better logistical performance and better operational stability. Moreover, process turbulence is positively associated with analytic capability and logistical performance, while demand unpredictability is negatively associated with analytic capability, logistical performance and operations stability.

The six papers included in this special issue not only provide important practical and theoretical insights of real-time supply chain optimisation and execution but also reveal interesting research topics in this emerging field. We hope this special issue would foster more research interests in developing technical models and in studying the managerial issues for enabling real-time supply chain optimisation and execution.

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