Editorial

This is the third in a series of special issues on intelligent management systems in operations. Like its predecessors, published in July 1998 and 2004, this issue is based on selected and refereed versions of papers that were presented at the European Conference on Intelligent Management Systems in Operations, held at Salford in 2005.

Our motivation for the first conference, held in 1997, stemmed from a perception that the AI and OR communities had followed different paths towards solving similar problems and that pursuing Simon's (1987) suggestion of combining AI and OR on the grounds that 'two heads were better than one', would result in greater success for operations management.

As our survey of trends based on over 1200 papers illustrates (Kobbacy *et al*, 2007), there has been a substantial increase in applying a combination of AI and OR in operations management since that first conference. This increased activity reflects the need to address the growing complexity that is inherent in a global market that is increasingly competitive and in even greater need of the kind of innovative solutions that result from combining AI and OR.

This special issue continues this theme and includes nine papers covering research in fault diagnosis, scheduling, ecommerce, preventive maintenance, forecasting and inventory management, and business performance improvement. The AI techniques employed include neural networks, genetic algorithms, fuzzy logic and Bayesian networks.

The special issue begins with a paper by Chan and McNaught that utilizes Bayesian networks to model the experience of engineers to improve the reliability of a fault diagnosis process for testing the base transceiver stations which manage the channels and signals to and from mobile phones. An evaluation of the developed system, known as Wisdom, shows a significant improvement in repair times for a range of fault types.

This is followed by a collection of three papers on scheduling, an area that continues to be the most vibrant area of application. The paper by Tavakkoli-Moghaddam, Safaei and Kah utilizes fuzzy set theory to model uncertain processing times in job-shop scheduling problems and extends a constraint satisfaction adaptive neural network for job-shop scheduling so that it is capable of dealing with fuzzy processing times. The paper includes an empirical evaluation that suggests that the approach is particularly suitable for generating feasible solutions when the objective is to minimize machine idle time.

The paper by Tavakkoli-Moghaddam, Safaei and Sassani proposes an approach for the solution of the cell formation problem in manufacturing when product mix and demand are different, and vary dynamically from one period to another. The paper formulates a multi-criteria nonlinear integer programming model whose objective is to minimize the sum of machine cost, and inter-cell movement cost. A simulated annealing algorithm is then developed for solving the formulated model. The paper concludes with an empirical evaluation of the algorithm that compares the solutions obtained with known optimal solutions.

The paper by Ławrynowicz tackles the problem of developing a system that is capable of revising plans and schedules in response to unplanned real-time events within acceptable time. The paper presents a hybrid framework that uses a rule-based approach to propose detailed production plans and a genetic algorithm that performs the scheduling. The approach is tested on an impressive list of real-world problems including manufacturing of agricultural parts, production of electrical equipment, manufacturing of parts for the building industry, and production of hydraulic fixtures. An empirical evaluation of the system shows that the proposed approach results in significant improvements over a more traditional approach that utilizes dispatching rules.

The rapid growth of the internet has led to a significant investment in ecommerce. However, a number of studies have reported that many online shoppers are reluctant to complete their transactions online because of lack of trust. The paper by Meziane and Kasiran develop a framework that makes use of automatic information extraction methods to help users evaluate online sites. The paper begins by surveying the factors that affect trust and then proposes a measure of trust based on the key factors. An information extraction system that is capable of identifying the required factors is implemented and the results of an evaluation on a sample of a hundred ecommerce sites are presented.

The paper by Boylan, Syntetos and Karakostas addresses the issue of classification of demand patterns for forecasting and inventory management. Very little work has been conducted in this area and, from the limited research to date, it is not clear how managers should classify demand patterns for forecasting and inventory management. The authors argue that categorization rules constitute a vital element of intelligent inventory management systems that are capable of forecasting and controlling stock. In this paper,

the stock control aspects of such an approach are assessed by experimentation on an inventory system developed by a UK-based software manufacturer. The empirical results from this study demonstrate the considerable scope for improving real-world systems.

Many world class organizations have exploited the process focused, statistically driven Six Sigma methodology to business performance improvement. However there is still less documented evidence of its implementation in Small and Medium-Sized Enterprises (SMEs). Antony, Kumar and Labib report the key findings of a Six Sigma pilot survey in UK Manufacturing SMEs. The results of the study are discussed and the critical factors for the successful development of Six Sigma in SMEs are identified.

The bullwhip effect in supply chains describes the counter-intuitive situation whereby orders at upstream levels of the supply chain can exhibit more variability than those at downstream (customer). This effect increases if demand variability changes as in the case of new markets. Pearson, in his paper on process control in supply chain networks and push-pull strategies, addresses the situation where changes in demand and supply levels trigger changes in variability. The author outlines a range of feedback mechanisms which monitor and restore equilibrium in a supply chain. One of these is prediction capability charts which monitor the process and are used by the decision makers to profile the allocation of inventory in the supply chain and identify out of control conditions. They maintain quality within the network, as well as intelligently track the way the network evolves in conditions of changing variability. An example of simulating a push strategy in the clothing industry is used for illustration.

The paper by Alardhi and Labib presents an integer linear programming model which schedules the preventive maintenance tasks in a multi-cogeneration plant, which produces both electric power and desalinated water. This is a typical complex process with long-term operations and planning problems. The plants' maintenance scheduling process has to determine the appropriate schedule for preventive maintenance, while satisfying all of the system constraints and maintaining adequate system availability. It is an optimization problem and the maintenance and system constraints include the crew constraint, maintenance window constraint and time limitation constraint. Results of a test example of such a plant situated in Kuwait are presented to show the applicability of the approach.

As the papers in this special issue show, there are significant benefits in combining AI and OR for operations management and we hope this special issue inspires further work in this area.

We would like to dedicate this special issue to the late Tony Christer, who encouraged our efforts to establish the series of conferences and inspired our interest in the field.

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References

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