Editorial: New features and inventory insights

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Biographical notes: Ata Allah Taleizadeh is currently an Assistant Professor in the School of Industrial Engineering at the University of Tehran in Iran. His research interest areas include inventory control and logistics, pricing and revenue optimisation, game theory and uncertain programming. He has published extensively in leading journals such as *OMEGA*, *European Journal of Operational Research*, *International Journal of Production Economics*, *IEEE Transactions on Systems, Man, and Cybernetics: Systems*, etc. He is currently the Editor of *International Journal of Inventory Research*, and serves as an Associated/Area Editor of several journals such as *International Journal of Systems Sciences*, *International Journal of Industrial Engineering: Theory, Applications and Practice*, *International Journal of Applied and Computational Mathematics*, *International Journal of Systems Sciences: Logistic and Operations*, *International Journal of Industrial Engineering*, and *IIE Transactions on Healthcare Systems Engineering*.

1 Introduction

The *International Journal of Inventory Research* (*IJIR*) has started publishing since 2008. We are pleased to tell readers and our editorial board members that *IJIR* has received a lot of submissions in 2016 and hence, we believe that *IJIR* will be published quarterly from 2016. This editorial is prepared for Vol. 3, No. 3, 2016 in which four papers from four different countries including the USA, China, Canada, and India are published. Two published papers belong to the perishable inventory system and stochastic inventory control related models. Multi-echelon inventory control system and revenue management are two other topics of the remaining two papers. As the third editorial of 2016, a discussion of the 'inventory insights' developed by each paper and also a clearer picture of the significance of the papers are prepared in this editorial. Moreover, the updated average review time of *IJIR* is 69 days, showing the high commitment of the associated editors and editorial board members to ensure quick and fair reviews, and publication decisions for *IJIR* submissions.

2 Inventory insights

This issue of *IJIR* includes four research papers. The findings and insights generated them are summarised in the following.

'Recent advances on Markovian models for inventory research' (by Tai and Ching): Markovian models are commonly used in modelling many practical systems and have a wide range of applications in management science. One of the major applications is in modelling stochastic inventory systems. Markovian models for some important events in inventory management, such as demand and supply processes, have been studied in the literature. The objective of this paper is to give a comprehensive literature review on the studies of Markovian models for inventory research that have been published since the early 2000s. In the first section, Tai and Ching reviewed inventory models with exogenous Markov-modulated demand. Discrete-time Markov process, continuous-time Markov chain and discrete-time Markov chain are three streams of studies under review in this section. The authors believe that, comparing with discrete-state Markov chains, few research works adopt continuous state Markov processes in their models. Not only does demand process, but also some other factors may affect inventory management decision. These factors such as breakdowns, repairs, maintenance, learning, etc., can be modelled by Markov processes. The second part of the review is hence assigned to Markovian models with these other factors. Discrete-time Markov process, continuous-time Markov chain, discrete-time Markov chain, and hidden Markov models are different aspects of reviewed papers in this section. In the third section, different streams such as stocking decision, inventory routing problem, semi-Markov decision process, and Markov game are the main topics of papers reviewed. Discussions on system states in Markovian models and also applications in industries are two categories of the paper for which a comprehensive review is performed. At the end, several directions for future researches are presented for researchers.

'An analysis of replenishment policies for perishable inventory system with postponed demand and multiple vacations' (by Radhamani, Sivakumar and Arivarignan): This paper considers a perishable inventory system with postponed demand and single server such that the server is allowed to take multiple vacations during stock out period. A continuous review perishable inventory system in which demands occur according to a Markovian arrival process (MAP) is developed. The given system has a maximum inventory capacity to meet the demands. The items are assumed to have identical and independent exponential life time. When an item perishes, it is removed from the stock. The items are replenished either by a variable ordering policy or by a fixed ordering policy. So two different models entitled 'system with variable ordering policy' and 'system with fixed policy' are examined. The authors have derived various system performance measures and the waiting time distribution of demands in the pool for both models. Using these performance measures, the total expected cost rates of both models are calculated and these results are numerically illustrated. The authors have shown that the optimal total cost rate and the mean waiting time of demands in the pool are minimum for the variable ordering policy and present the effect of arrival correlation and the impact of squared coefficient of variance of vacation time, lead time and selection time on total expected cost rate numerically. As an important finding of this paper, one can observe that the variable ordering policy is better compared to the fixed ordering policy.

'Joint planning for spare parts inventory and preventive maintenance in a multi-echelon network' (by Shi, Xiang, Jin and Li): This paper investigates the inter-dependency between spares inventory provisioning and preventive maintenance (PM) scheduling in a multi-echelon network. Shi et al. perform a set of simulations in order to obtain adequate performance data to assess potential advantages of joint

decisions, and also identify the needed system indicators. The major findings of their research are as follows. First, for a multi-base service network, if the ratio between PM and corrective maintenance cost/delay time is low, preventive replacement is not a dominant policy. Rather a mere spare part inventory policy without PM is sufficient. However, if the ratio is high, a joint maintenance-inventory decision is preferred because PM can generate higher service profits. Second, long transportation time requires a higher reorder point and more scheduled replacements, when the ratio between PM and corrective maintenance cost/delay time is high and PM is needed. It is necessary to maintain a sufficient level of on-hand spare parts so that equipment can continuously operate with less delay caused by PM actions. Also, their results show that high system availability does not guarantee high service profitability; neither does a low cost level. Since the majority of scenarios require shorter PM intervals, while others yield larger profit margins with longer PM intervals, an appropriate balance between maintenance cost and system availability is critical. For future research, the authors propose that future efforts can be focused on expanding the simulation events in order to obtain a more comprehensive comparison. Considering other inventory policies (e.g., (R, Q) policy) as well as predictive maintenance policies (e.g., condition-based maintenance) are other future research directions. The current model assumes a closed-loop repair process without external suppliers. It would be more realistic to generalise the model by accommodating both external suppliers and transshipment among bases.

'How does wholesale price depend on initial inventory at retailer?' (by Gerchak): Gerchak discusses in this paper an integrated inventory-pricing model. Firstly, the author considers a setting with a fixed retailing price. After finding how the retailer's order quantity depends on the wholesale price and on the initial inventory, he explores the wholesale price's dependence on (known) initial inventory and reveals that *it depends on problem parameters*. Then, similar settings but with a retail pricing decision is developed. Two different demand functions:

1 linear with additive noise (in some detail)

2 linear with multiplicative noise (an outline) are used to model the relation between the demand and retail price.

The retailer selects both order quantity and retail price, and the manufacturer, who determines the wholesale price, has to consider its impact on retail price and thus on demand. As an important finding, when demand is random, the wholesale price is *not always* decreasing in the amount of initial inventory. This result implies that building of strategic inventories is not always profitable. The main future research direction proposed by this paper points to exploring a discounted infinite-horizon (repetitive) setting.