Editorial

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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 Associate/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 and we have achieved great success in 2017. To be specific, we have got many high quality submissions from world leading experts and we continue to feature timely special issues related to inventory research.

In this editorial, we introduce the special issue entitled *Advances in Inventory Management under Uncertainty* in which five papers from five different countries including the India, New Zealand, USA, Italy, and Iran are published. As usual, a discussion of the 'inventory insights' developed by each paper and a clear picture of the significance of the papers are prepared in this editorial.

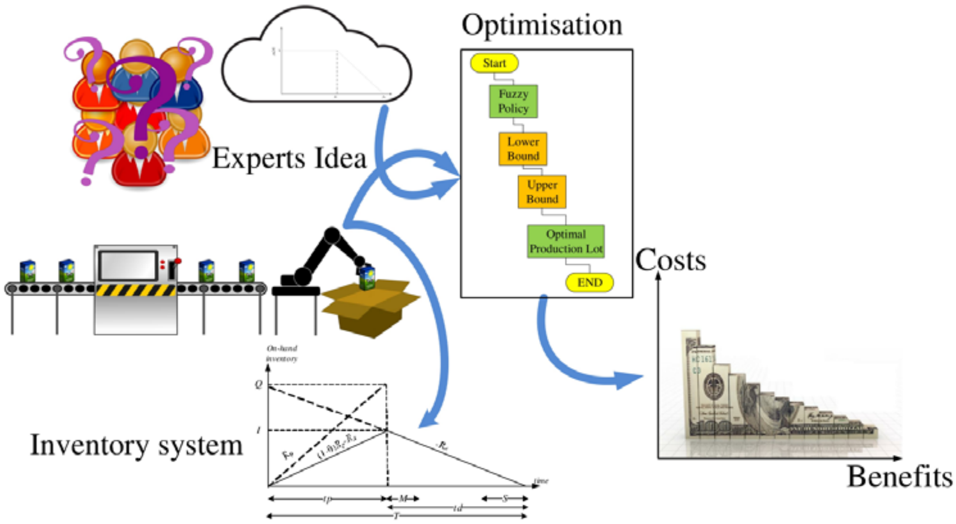
2 Inventory insights

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

All organisations want to increase the number of consumers for their produced product. For that, they offer different types of promotion offers, discount and financing policies. Moreover price is also one of the key factors in inventory control and the retailer has to consider it when making decisions. However, while developing the inventory model under permissible delay in payments exist in the literature, authors generally assumed that retailers have to settle their accounts at the end of the credit period, i.e., suppliers only accept the full amount at the end of the credit period. However, in reality, suppliers may accept the partial amount at the end of the credit period with unpaid balance settled in due course. Moreover, the supplier may also accept the full amount at a fix point after the expiry of the credit period instead of accepting the partial payment, if the retailer finances the inventory from the supplier itself. Hence, the first research of this special issue, by Tiwari et al. establishes an inventory model, which considers the above-discussed realistic approach for settling the accounts when suppliers offer permissible delay in payments under fuzzy environment. The objective of the inventory model is to determine the optimal order quantity, the optimal selling price and the optimal replenishment schedule to maximise the total profit function. The paper deals with the inventory system from the retailer's perspective where its customers are getting credit period. This work provides a new perspective to model and provides a better alternative for decision making for practitioners.

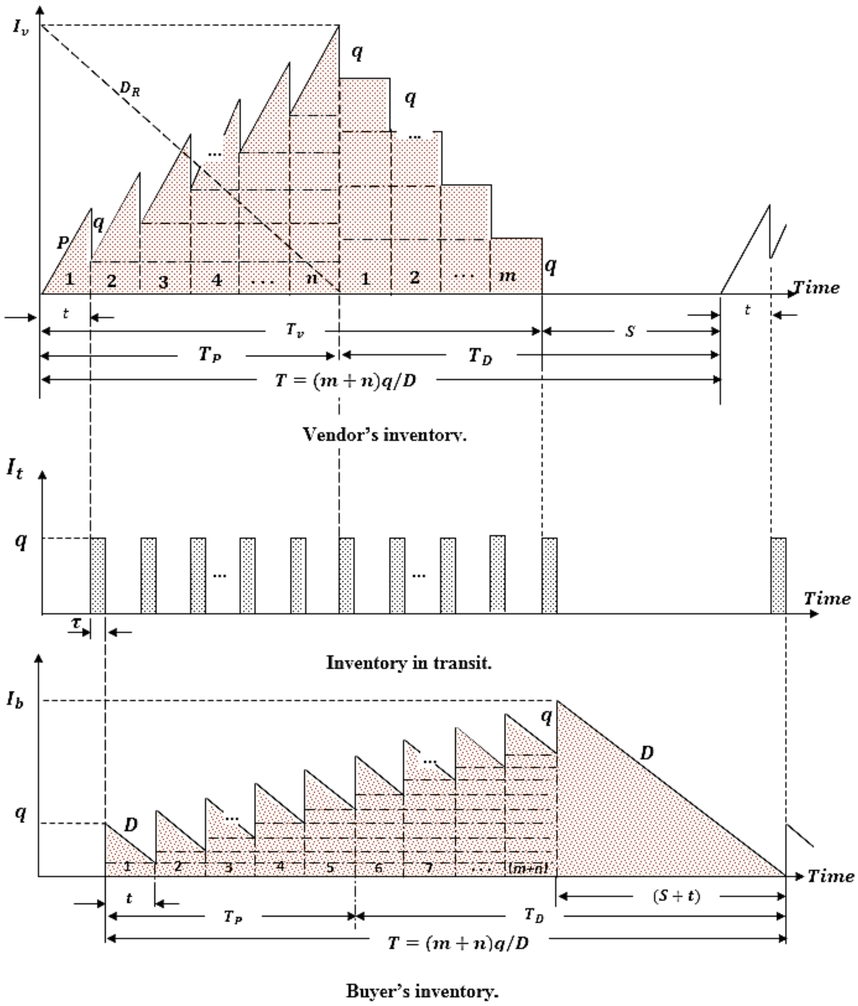
Production and manufacturing processes under environment processes are important topics with which many studies are performed. In this special issue, a fuzzy mathematical programming model for an inventory control problem with defective items is considered by Nobil and Sedigh. In this system, some unacceptable items should be disposed at a constant cost. Moreover, maintenance is a vital part of most production systems to increase machine life span and to decrease system costs by reducing defective items. So, the production system under study consists of a single machine that benefits from maintenance to enhance its efficiency, performance, and lifespan. In real-world scenarios, estimation of machine uptime is hard and faces environmental uncertainties. As a result of uptime estimation based on the linguistic variables, i.e., experts ideas, the inherited uptime would be a fuzzy parameter itself. This fuzzy variable has a trapezoid form, i.e., machine works certainly up to a time then it stops working at a time that this time. Based on the maintenance policy, the machinery should be stopped to go through a preventive procedure during downtime. In other words, we consider a nonlinear EPQ inventory model suffering from defective production that has a constant demand rate as well as constant production rate. A certain percentage of produced items are scrapped, the preventive maintenance takes place in some predefined periods and machinery requires a setup afterwards. In this system, the shortage is not allowed and demand should be fully satisfied. Other constraints of the system include production capacity and maximum uptime that should be taken into the account in optimising the model. The proposed model helps production managers to reduce system costs and defective items by improving machine efficiency and performance employing appropriate maintenance policies. To solve the proposed problem, the authors optimise the system costs, i.e., production costs, setup costs, disposal costs, holding costs, and maintenance costs, by calculating the optimum production cycle. To obtain the optimum solution, an algorithm is proposed to calculate the upper and lower bounds of the inherited crisp problem. Finally, a numerical example is provided to investigate the effectiveness of the proposed algorithm. A graphical abstract of this work are presented in Figure 1.

Figure 1 Graphical abstract of Nobile et al.'s work (see online version for colours)



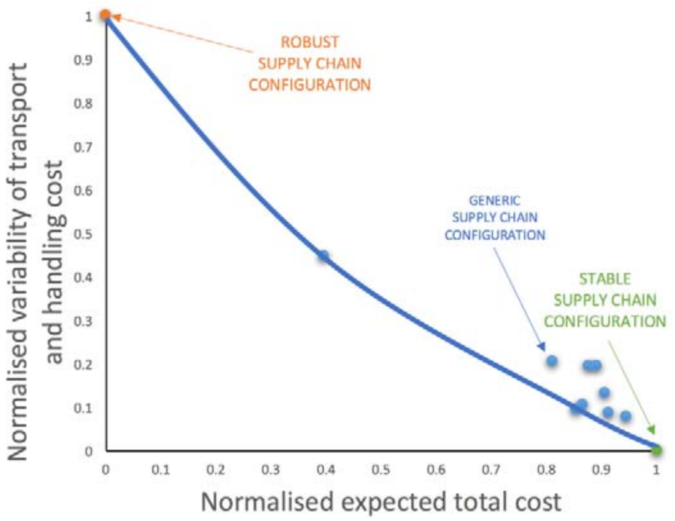
In a product-supply chain, a product goes through a number of stages, and at last reaches the end consumer. Each of these stages involves at least two entities, where one entity delivers his goods to the next downstream entity. The upstream entity can act as a vendor or manufacturer or supplier and the downstream entity can act as a retailer or buyer. Several coordination mechanisms for this two-stage supply chain has been studied over the last few decades. Different mechanisms are applicable in different situations. One of the well-known mechanisms is *consignment stocking*, where the vendor stores his products at retailer's warehouse. In some cases, the retailer pays off for the product after the product is sold while the demand or lead time is probabilistic in nature. In consideration of a single-vendor and single-buyer consignment stocking policy, a new coordination mechanism is investigated in the third paper of this issue by modelling the system with periodic inventory audit, unused item removal and in-transit inventory holding costs. In this research, a single-vendor (manufacturer), single-buyer supply chain system under consignment stock (CS) policy is studied for a single product by Sarker et al. The system operates in a manner where the vendor ships a lot of product with a size to the buyer's warehouse which is collaboratively managed by the vendor as well (see Figure 2). The *main goal* of this work is to formulate an integrated inventory model of a single-vendor, single-buyer long term CS policy agreement for a single item, by accounting the effect of lead time on both partners and inventory audit cost for the buyer. The proposed model boosts up the vendor-buyer cooperation one step closer to the real situation. The specific objective is to minimise the joint total cost by optimising the order quantity and the number of shipments in a replenishment cycle. In order to do this, the ordering, holding and inspection costs for the buyer, and the set-up, holding, unused items removal and transportation costs for the vendor are incorporated into the model as system parameters. All cost elements for the vendor as well as the buyer are evaluated separately. Then these costs are combined to find the joint total cost for the integrated system. After generating the total cost function, an iterative search approach follows to find the optimal solutions for order quantity and number of shipments. Computational results are presented for a practical instance and some empirical studies are reported.

Figure 2 Composition of the inventory in the system (see online version for colours)



Efficient design of distribution and delivery of products to customers in globally extended supply chain networks is a crucial issue. The fourth paper of this issue, by Zanoni et al. focuses on the design of a supply chain, taken into account the variability of the final customer demand. The novelty of this contribution resides in the investigation of an alternative way to face the uncertainty, named the stable approach, which aims to determine the minimum variability of transport and handling cost in the considered time horizon. In particular, the authors study the design of a one-to-many distribution system, considering the product flows from the producers to different distribution centres and the retailers, as well as the reverse flows from the retailers to the producers. The optimisation procedure consists of two main steps: the first step is the definition of the number of producers and distribution centres to include in the network, jointly with their location; the second step is the definition of the products flows from producers and distribution centres to retailers, in order to satisfy their specific demand. The fluctuating demand of the products over the different regions, represented by the demand of retailers that serve such regions, influences the optimal solution for the different periods considered. The goal is to find the network configuration that can efficiently operate under the uncertainty of the customer demand. A numerical analysis has been performed over a realistic case study dataset and results on robustness and stability, and hybrid solutions have been reported. The graphical abstract of work is presented in Figure 3.

Figure 3 Graphical abstract of Zannoni et al.'s work (see online version for colours)



Production and procurement management in a supply chain is considerably affected by random yield and random demand. The last work of this special issue, by Esmaeili and Zarea, considers a supply chain including a supplier who faces random production yields and two retailers who face uncertain demand. Using the Stackelberg game approach, two models are proposed to consider discount coordination of the retailers with respect to the risk sharing (RS) and no risk sharing (NRS) contracts. Although the models consider two retailers, the authors argue that their obtained results would be generalisable for several retailers. With the NRS contract, the retailers do not accept RS, but every retailer knows the demand function and discount percentage in complete information and each of them tries to maximise its own profit function separately. The RS contract contains a combination of the underproduction and overproduction risk sharing strategies (URS, ORS). In the URS strategy, the supplier uses an emergency source to achieve the unmet order quantities and does not bear the risk alone. Furthermore, in the ORS strategy, the supplier considers quantity discount for overproduction. The supplier specifies the quantity discount percentage and the wholesale price. Then, retailers determine their optimal order quantity in which their profit is maximised. Finally, the supplier determines production quantity. The retailers' optimal order quantities and the supplier's production quantity are obtained for these two models. Numerical examples are presented. Consequently, comparing the contracts shows that the retailers' discount coordination gains the maximum possible profit under certain conditions. Also if the supplier decreases the margin profit, retailers have more motivation to participate in the RS contract. Generally, the result follows our intuition and the supply chain performance is improved as the retailers coordinate on order quantities under certain conditions. The graphical abstract of this research is presented in Figure 4.

Figure 4 Graphical abstract of Esmaeli and Zarea's work