Abstract

Inventory Management and Supply Chain Management are the most important branch of Operational Research and Management Science. Incorporation of real life situations in the modeling of inventory management and supply chain problems acquired as the key area of research in the recent trends. It provides the competitive advantages, as well as an efficient flow of the commodity that finally gives economic benefit. On the other hand, it increases the operational complexity in order to the modeling of these problems. Thus, the inventory modeling and supply chain modeling are interesting as well as a challenging task also. The modern advanced information technology and computer sciences provide better business strategy and maintain ultimate coordination among the business partners. The application of these sciences is most favorable in business management to minimize the aggregate cost and maximize the customer service. On the other side the key parameters of modeling problem such as demand, cost, planning horizon, etc. frequently changes. Thus, the complexity of inventory modeling problem has increased in recent years. In this regards, many mathematical and statistical tools and methods are required to handle decision-making process in these areas. In this connection, this thesis provides some practical integrated inventory systems and supply chains models by considering trade credit finance, deterioration, preservation technology, set up cost reduction, etc. in the stochastic framework.

The centralized decision-making process to optimize the supply chain (SC) has been widely used in recent past, because it minimizes the total cost and improves the efficiency of entire SC. The thesis uses the same approach for items with imperfect quality, wherein set-up cost reduction and trade credit finance also considered. In this process, two integrated SC models developed. In the first model, shortages are not allowed whereas in the second model it is allowed and is mixture of backlogging and lost sale. One more integrated SC model is developed for time dependent ramp type demand by considering trade credit finance. The model is developed with two types of shipment policies, namely, on equal time interval (ETI) and equal lot size (ELS).

In the supply chain hierarchy, a supplier is relatively in more powerful position and decides when to visit and replenish the retailer's order quantity. Moreover, it may be possible that the retailer's shop is situated in the disadvantageous remote location, and regular replenishment and visit process may not be accomplished. In such situations, the review period may be a random variable. By considering random planning horizon or random scheduling period, the thesis presents some stochastic inventory models that incorporate preservation technology, special sale offer, two-warehouse model, etc. Eventually, this thesis is developed through some methodologies to optimize the mathematical model. In this process, several mathematical tools and software such as com-

putational algorithms, Mathematica and MATLAB software have been used. Finally, in each case, the mathematical formulation is illustrated with numerical experiments and its sensitivity is analysed by changing the value of key parameters.

Keywords: Supply chain, Inventory, Production, Ramp-type demand, Deterioration, Preservation Technology, Partial backlogged, Single-vendor, Single-buyer, Imperfect quality, Stochastic planning horizon, Special sale offer, Two-warehouse, Two-echelon integrated-inventory system, Screening process, Trade credit, Non-instantaneous deteriorating items, Variable setup cost.