Abstract

In today's business landscape, companies are facing challenging competitive environment and are eager to find the best way to manage inventory at the most efficient and profitable way. Due to globalization and industrialization, the consumption rate of the commodities, product availability, product variety, global market are increasing day by day. On the other hand governments are imposing strict rules and regulations to minimize the pollution from over-production and over-consumption. Thus, managing and maintaining the production and inventory have become extensively complex. Taking all of these into account, the present thesis attempts to develop some realistic inventory (EOQ, EPQ) and supply chain models which are simple in nature in terms of computation. The major contribution of the models discussed in the thesis include: strategy under competitive environment, demand rate dependent on selling price and production run time, functional dependence of pollution rate over production rate, inclusion of risk factor, recycling in production, dealing shortages by product substitution etc.

Moreover, due to information technology, social media, digitalization, market expansions companies are overwhelmed by huge amount of information from different suppliers and consumers from various geographic locations. These information are often composed of both structured and unstructured data, insufficient information and imprecise data records. Hence for proper management of these raw and uncertain data into compatible formats, consideration of fuzzy set theory is very essential. Through this thesis, we have developed five inventory and supply chain models with various uncertainties and imprecision in the key parameters. To handle the uncertainty in the fuzzy parameters, several solution methodologies have been developed. Also, we use various mathematical tools such as Lotka-Voltera predator-prey model (two species and three species), goal attainment method, fuzzy goal attainment method, hesitant fuzzy set theory, several aggregation operators on hesitant fuzzy set theory, triangular dense fuzzy rule, triangular dense fuzzy lock set rule etc. as per requirement.

Keywords: Inventory control, Deterioration, Natural idle time, Einstein aggregation operator, Decision making, Bi-objective inventory, Correlation coefficient, Goal attainment approach, Fuzzy goal attainment approach, Discounts, Demand uncertainty, Impreciseness, Production inventory, Backorder, Preservation technology, Pollution, Risk, Remanufacturing, Hesitant fuzzy set, Triangular dense fuzzy set, Triangular dense fuzzy lock set, Product substitution, Multiple supplier, Single retailer, Defective items, Supply chain, Optimization.