

Abstract

In real life business scenario, one of the major difficulties being faced by the decision makers is to forecast certain essential parameters such as demand and deterioration rates of items. Demand, in general, appears to be uncertain as it depends upon several factors, such as availability, price, season, etc. Likewise, item deterioration rate is also observed to vary with the surrounding circumstances and warehousing facilities. These give rise to situations which cannot always be handled by the consideration of constant, time-varying or even fuzzy (with crisp membership grade) demand and deterioration rates. Instead, the parameters can be well modeled using fuzzy rule base approach or they can even be presented as type-2 fuzzy sets. Addressing similar situations, a significant contribution of this thesis lies in considering discrete type-2 fuzzy deterioration rate, interval type-2 fuzzy demand, fuzzy rule based demand and deterioration rates. Some novel methodologies for solving type-2 fuzzy optimization problem and defuzzifying interval type-2 fuzzy numbers are also proposed.

Moreover, increasing rate of environmental degradation and resource extraction being serious issues in today's growing economy, the objective must not only lie in minimization of the overall system cost but also in reducing the adverse environmental impact at the same time. One of the greatest challenges in current times is the efficient management of deteriorating items whose utility gets reduced over time due to decay and spoilage. Although certain facilities (refrigeration, for instance) are often adopted as effective strategies to improve the management of perishable products, simultaneous generation of carbon emissions due to warehousing procedures grows an industrial interest to study the effects of carbon emission regulation as well. In this regard, the major contributions include simultaneous minimization of cost and emission under different emission regulatory policies and raising environmental concerns through vehicle routing decisions in supply chain modeling.

Each of the aforesaid scenarios being taken into consideration, the present thesis attempts to develop production inventory modeling problems for deteriorating items which encounter a bunch of unexplored real life situations.

Keywords: Production inventory, Deterioration, Backlog-dependent demand, Imperfect production, Inspection errors, Rework, Shortages, Type-2 fuzzy demand and deterioration, Nearest interval approximation, Supply chain, Vendor-buyer coordination, Fuzzy rule based demand and deterioration, Carbon emission, Emission regulation strategies, Vehicle routing, Optimization.