MATHEMATICAL MODELS OF SOME DECISION MAKING PROBLEMS IN UNCERTAIN ENVIRONMENTS

A Thesis Submitted in Partial Fulfillment of the Requirements
for the Degree of
Doctor of Philosophy
in
Mathematics

by

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June, 2022

ABSTRACT

Decision making is an essential and integral part of various business organizations, public administration, etc. The management of a system uses mathematical models to make a decision rationally and adequately, as a wrong decision may spoil the objective. The values of the parameters involved in practical decision making problems are not always deterministic. This is because of the use of some linguistic terms to define the parameters, lack of clear information, etc. In this dissertation, some real-life decision making problems on transportation, inventory control and supply-chain management are described, formulated and illustrated. Two four dimensional transportation problems (4D-TPs), two inventory control problems with credit periods and two green supply-chain (GSC) management problems are studied in various uncertain environments such as fuzzy, random, rough, random type-2 fuzzy etc.

In transportation models, different uncertainties in several parameters of 4D-TPs are considered, and appropriate decision making processes are demonstrated. The importance of routes as a dimension of transportation problems is described, studied and established. In inventory control problems, the credit periods are taken as uncertain to frame more realistic models. To reduce default risk due to credit period taking customers, the concept of reminder cost is introduced in the literature, implemented, and its importance to increase the profit is explained. A new payment policy for the retailer to clear the last dues of the supplier(s) after the credit period for maximum profit is illustrated numerically. Some single / multi-objective GSC models are formulated, and the importance of greenness in the supply chain is illustrated. For the single objective GSC model, sharing of various demand increasing attributes such as greenness cost, service cost and promotional cost by retailer and manufacturer is studied and solved by game-theoretic approach. Various profit situations of the retailer and manufacturer under different leader-follower scenarios are investigated. In the multi-objective model, a four-echelon GSC is studied by considering the cost of carbon emission and other environment polluted parameters.

In the formulation of the models, some new hybrid uncertainties such as random type-2 triangular fuzzy, etc. and their deductions are introduced in the thesis. For optimization, some existing techniques, such as the step method, fuzzy age-based genetic algorithm, etc., are accordingly modified and used. Models are numerically illustrated, and some managerial decisions are presented.