Chapter 11

Conclusion and scope for future studies
11.1 Conclusions

During the last few decades, stochastic programming and fuzzy programming have been applied to a wide variety of disciplines such as mathematical programming including queuing theory, inventory control, transportation problem, control theory etc. There are also various real life applications considering both types of uncertainties using fuzzy stochastic multiobjective programming and the research work on this topic is growing rapidly.

In this thesis, different aspects of fuzzy stochastic multiobjective programming problems to decision making problems have been described systematically by exploring methodologies for solving fuzzy multiobjective probabilistic programming problems and applying them to different real life problem. As a special field of fuzzy multiobjective probabilistic programming, fuzzy chance constrained programming with single objective as well as multiple objectives having fuzzily described random variables associated with the system constraints following normal distribution have also been discussed in greater detail. The other types of continuous distribution which have greater impact in different real life planning problems like uniform and exponential distribution have also been taken into account in succession.

Considering both types of uncertainties associated with objectives as well as system constraints an E-model has been framed to solve fuzzy multiobjective stochastic programming problem involving fuzzily described normal random variables which have extensive implication in different planning context. A variety of fuzzy multiobjective stochastic programming has been presented in the form of bi-level fuzzy stochastic programming in a hierarchical decision making horizon.

The application potential of the developed methodologies have been explored via the case example of solving unbalanced transportation problem with fuzzy random supply and demand and land use planning in agricultural systems.

It is worthy to mention here that, from the view point of methodological development and applications to different decision problems fuzzy multiobjective stochastic programming is still young in compare to conventional multiobjective stochastic programming and also multiobjective fuzzy programming.
Hence, deep study in this field is essentially needed to make it powerful tool for real world decision making.

The extensive study in future on fuzzy multiobjective stochastic programming is foreseen in the next section.

11.2 Scope for future studies

In the last two decades, the field of fuzzy multiobjective stochastic programming has grown rapidly due to the pioneer contributions of the active researchers in the field. But, efficient methodologies for modeling and solving multiobjective decision making problems in probabilistic fuzzy environment is relatively young in the context of real world decision making.

In the preceding chapters, a few of the topics for future research on the study materials have been already discussed. However, some of the areas in which deep study in future are essentially needed may be summarized as follows:

I. The duality theories, sensitivity analysis, supply chain management and inventory control in fuzzy stochastic environment has yet to be widely circulated in the literature. Methodological developments in these fields are urgently needed from the point of view of their potential use to different types of practical decision problems.

II. The extensive study in the field of fuzzy stochastic nonlinear programming is yet to appear in the literature. Methodological development for solving different types of nonlinear programming problems involving fuzzy random variables including fractional programming, geometric programming problems are at an early stage.

III. As a special area of study, more research in the field of fuzzy stochastic bilevel as well as multilevel programming is highly needed for proper distribution of decision power to the decision makers in a decentralized planning systems and thereby making overall benefit of an organization.

IV. In real world complex decision making context, the application of fuzzy probabilistic programming in areas like portfolio selection, solid waste
management, scheduling problems, environmental systems, energy investment problem, agricultural planning problems, farm planning problems become emerging area of study for the researchers. So, the extensive study in the field is highly required in future.

The potential use and efficient methodology of fuzzy stochastic multiobjective programming to a wide variety of real life problems has been discussed in the preceding chapters of the thesis. It worthy to mention here that the theories and techniques are developed for solving different real world problems with a view to welfare of the human and other living systems on this earth. Hence, the wide use of fuzzy stochastic programming methodologies to real-life problems with real decision makers would probably be one of the prominent areas for future research.

Finally, it is hoped that the methodology development of fuzzy stochastic multiobjective programming and its wide applications to real world decision problems would derive it to a “workhorse” for multiobjective decision making in probabilistically imprecise environment in near future in the modern intricate decision making arena.