



Multi-Criteria Gain Loss Method for Informed Decision Making

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Decision analysis is primarily a prescriptive discipline, built upon normative and descriptive foundations. In all decision making situations, an individual decision maker (DM) arrive at any decision through some conscious and unconscious processes of their brain. In a conscious decision making situation, the DM must have complete information about the problem, the criteria, the alternatives, the methods and their consequences before arriving at any decision. This scenario is known as informed decision making situation. Since, all the discrete alternative multi-criteria decision making (MCDM) methods relies on the preferences of the DM on objective values of the alternatives, the role of the DM is very crucial. This necessitates that the MCDM methods used by the DM in an informed decision making situation to solve a multi-criteria decision (MCD) problems must conform to the cognitive capabilities and descriptive realities of the DM.

Most of the existing MCDM methods (like AHP, ANP, MAUT, PROMETHEE) are based upon normative foundations that consider the DM as rational with unlimited cognitive capacity and will always tend to optimize their decision. However, there are instances in reality where the actual decision differs from the optimal one, especially under uncertainty. Thereafter, these caveats were explained through new theories developed particularly in the field of psychology and behavioral sciences. These theories are concerned with the development of different models and concepts that can better explain the decision making process of human beings. Even though the role of the DM is prominent in discrete alternative MCD problems, only a few attempts are made in incorporating behavioral and psychological phenomenon of decision making in the MCDA. Further, there is hardly any work where the MCDM methods are used for rank order calculation in an informed decision making situation. Most of the applications of various MCDM methods, especially the AHP method concentrate on the problems those are difficult to solve directly without the help of computing machines. This warrants any kind of cross-checking with any perfect solution, as it is not available. Also, there is hardly any publications on the verification of the potential of the AHP method even for simple informed decision making problems that the human beings deal regularly such as purchase of some household products etc.

This research work addresses the necessity of developing a systematic way to verify the effectiveness of any MCDM method on a set of problems where human beings take the

decision with relative ease. Further, this research emphasizes on the use of benchmark decision situation for assessing the capability of any MCDM method before applying it to solve complex real-world problems.

In spite of the absence of any benchmark, the AHP based methods are being used extensively across applications in various industries. Through systematic experimentation, it is shown that the traditional AHP method may not be suitable for addressing informed decision problems. Further, it is also shown that the AHP method in its present form is limited to address informed decision problems, and so, it is needed to relook at the way each of the processes used in the AHP method. The ratio scale for preference elicitation and unrealistic consistency constraints of AHP weaken its applicability for informed MCDA where the DM has complete information about the problem, alternatives, methods and the criteria. Experimentation with AHP indicated that there is a larger scope to develop new methods which will be simple to use, but at the same time will be able to capture true preference of the DM and aggregate them in a way to represent the actual decision making process of the DM.

Therefore, using some of the latest descriptive theories of decision making, the development and implementation of a novel method is proposed in this research, which is named as multi-criteria gain loss (MCGL) method. The proposed MCGL method is novel in the way preferences are elicited from the DM and the way these preferences are aggregated to resemble the actual choice behavior of the DM. By simplifying the preference elicitation, the MCGL method improves the performance of the DM, which in turn improves the quality of decision made by the DM. The MCGL method is able to model the decision making process of individuals under the framework of MCDA, by revising some of the MCDM mainstream postulates and practices in order to make them more suitable for solving real-world managerial decision problems. This research also explores and verifies how some of the concepts of descriptive theories of decision making can be used to enrich MCDA.

The potential of the MCGL method against the AHP method is tested and verified on two consumer decision making problems and one managerial decision making problem. The results conclude that the MCGL method is able to model the decision making process of the DM more accurately. Results also indicates that the valuations of discrete alternatives on various criteria are a nonlinear- reference point dependent function of the associated objective value of the alternatives. The integration rule, which best describes how independent valuations are integrated into overall valuations follow a non-linear, non-compensatory context dependent relation, overweighing the negative information. The applicability measures like the number of preferences required, time and the cognitive burden on the DM to remain consistent strongly favor the MCGL method against the standard AHP method. The MCGL method can serve as a simpler alternative against many of the well-established methods, especially the AHP and Multi Attribute Utility Theory (MAUT).