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ScienceDirect

Procedia Engineering 97 (2014) 1853 – 1865

Procedia Engineering

www.elsevier.com/locate/procedia

12th GLOBAL CONGRESS ON MANUFACTURING AND MANAGEMENT, GCMM 2014

Design, Development and Implementation of a Robust Decision Support Expert System (branDEC) in Multi Criteria Decision Making

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Abstract

In today's dynamic business scenario, in order to sustain within the global turmoil, decision plays a pivotal role. Today's market is completely driven with the choice of the consumer or the end user and toprolong this unprecedented uproar an adroit, firm and stable decision has to be taken. To acclimatize with the changing scenario, the situation demands for development of an expert system to expedite the decision making activity. Advent in MCDM (Multi Criteria Decision Making) techniques diffused with high end mathematical sub-layers isserving this purpose for the past decade. Literature survey reveals lack of availability of a robust expert system encompassing a numerous MCDM techniques, normalization techniques and weight determination techniques. Therefore this project is to mitigate this paucity and to develop a decision support expert system **branDEC-V:1R:1** [bran is an eponym derived by taking the first letter of the authors name and DEC is short form of"decision"]which can simultaneously harness all the existing offline MCDM methods and which make a decision avoiding time and computational complexity.

Selection and peer-review under responsibility of the Organizing Committee of GCMM 2014

*Keywords:*MCDM techniques;decision support expert system; aggregated/group decision making.

1. Introduction

For the couple of years MCDM has become the thrust area of research for dealing with complex decision making problems. The MCDM methodology can be envisaged as a non-linear recursive process comprising the

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Selection and peer-review under responsibility of the Organizing Committee of GCMM 2014
doi:10.1016/j.proeng.2014.12.339

following steps [1]: a) structuring the decision problem, b) articulating and modelling the preferences, c) aggregation of the alternative's preferences and d) making recommendations.

Structuring the DMS (decision making situation) appears to be an important step to infer a decision. This step includes the determination and the assessment of the stakeholders, the different alternatives, the consequences, the important aspects (criteria), the quality and the quantity of the information, etc. Existing methodologies pertinent to MCDM techniques in primarily based on twofold steps: construction and exploitation [2].

1.1. Philosophy and elements of MCDM

Multi-Criteria Decision Making (MCDM) is one of the most well known branches of decision making. MCDM is primarily divided into multi-objective decision making (MODM) and multi-attribute decision making (MADM)[3]. However, very often the terms MADM and MCDM are used to mean the same class of models. MODM studies decision problems in which the decision space is continuous having an objective function. On the other hand, MCDM/MADM concentrates on problems with discrete decision spaces in which the set of decision alternatives are predetermined [4]. Although different MCDM methods may have diverse protocols and stature; they all posed with certain common features. These common features include alternatives and attributes (decision criteria) [5].Usually alternatives entail a spectrum of different choice of desire duly available to the decision maker. For the present investigation the alternatives is assumed to be finite,ranging from several to hundreds wherein they all are supposed to be assessed, evaluated, and eventually ranked.Criteria represent the different adjudging measure with respect to which alternatives are adjudged from the suitability point of view. Decision weights play a pivotal role in MCDM problems, since the ultimate adjudging means (score, closeness coefficient, selection index etc.) is a function of weights of criteria present in the decision making problem. One can easily make the decision making problem biased by imparting more weightages to the intended criteria. Now a day's many emergent techniques have evolved to generate criteria weights from the discrete data.Decision matrix refers to an array which entails elements corresponding to performance of an alternative with respect to a particular criterion. Usually this is static in nature, for dynamic decision making problems the elements become time variant and eventually the choice of alternative may vary from time to time. The scope of the present project does not cover up the online decision making rather it deals with the static or offline counterpart. The constructional feature of a decision matrix has been addressed in.

1.2. Decision making framework

The present work encompasses design and implementation of an expert system which can cope and handle simultaneously a number of alternatives, criteria (ordinal and cardinal), available normalization techniques, weight determination techniques (singular, integrated and customized). In addition to these, to yield singular decision as well as group decision provisions have been made. The entire frame work has been shown in Fig.1.

1.3. Objective

Literature survey reveals that for individual decision making method, application software are readily available in both online and offline modes. Application software mostly lagging with a platform, where the decision maker can select a particular method to solve decision making problems. Therefore the objective of the present investigation is to develop a computer assisted decision aiding tool encompassing standard decision making methodologies to make decision by avoiding time and computational complexity. To achieve the same the following steps are followed:

- To extract and formulate decision making problems under deterministic utopian condition.
- To formulate and generate alternatives with regard to particular problem and to implement it.
- To Formulate and generate criteria which are either ordinal or cardinal in nature and to implement it.
- To formulate and implement suitable normalization techniques pertaining to different decision making methodologies.
- To implement different intelligent techniques to find out criteria weights as well as to make provision for customized (user driven) weights.
- To provide the option for decision making by individual method.
- To provide the option for group decision making through combination of decision outcomes of individual method.