VIKOR and its Applications: 
A State-of-the-Art Survey

Morteza Yazdani, Department of Business Management, Universidad Europea de Madrid, Madrid, Spain
Felipe R. Graeml, Department of Business Management, Universidad Europea de Madrid, Madrid, Spain

ABSTRACT

Recently, Multiple-Criteria Decision Making (MCDM) tools have increasingly been expanded to help researchers and practitioners to evaluate and select the best compromise alternatives. Among popular MCDM methods, Vlsekriterijumska Optimizacija I Kompromisno Resenje (VIKOR) has attracted much attention to cope with complex problems with conflict factors. The current study conducted a state-of-the-art literature review to embody the research on VIKOR and its applications. The paper structure consists of 198 papers from more than 100 journals and conference proceedings since 2002 which were classified into nine categories: 1) Design and manufacturing management, 2) Business and marketing management, 3) Supply chain and logistics management, 4) Environmental resources and energy management, 5) Construction management, 6) Education management, 7) Health-care and risk management, 8) Tourism management, and 9) Other topics. The last topic contains Information and knowledge management, Mine industry, etc. The study also proposes four classifications: 1) Publication year, 2) Journals, 3) other techniques combined or compared with VIKOR, and 4) Keywords distribution by VIKOR papers specifications. Finally, it was proposed forthcoming areas of study and recommendations for practical means. This study intends to generate insights on decision making techniques.

Keywords: Application Area, Compromise Solution, Literature Survey, MCDM, VIKOR

INTRODUCTION

Operational research (OR) includes the use of advanced analytical techniques to improve decision making. It sometimes is defined as operation research or management science. Multiple criteria decision making (MCDM) or multiple criteria decision analysis (MCDA) are sub-discipline and well-known chapter of operation research. These methods have grown to design computational tools to evaluate a finite number of decision alternatives under several factors or criteria by a group or single of decision makers (Lootsma, 1999). They have been utilized in many fields of research as; information technology, economics, medicine, software engineering, and mathematics. Many books and journals have disserted some research contents associating MCDA/MCDM from 1960 (Roy, 2005). These methods are designated to select

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alternatives, categorize them into a group and rank based on a preference or priority. There are number of studies which investigated the literature review of MCDA/MCDM; (Behzadian, 2010) on PROMETHEE, (Behzadian, 2012) on TOPSIS, (Vaidya, 2006; Ho, 2008) on AHP, and (Emrouznejad, 2008) on literature analysis of DEA.

Vlsekriterijumska Optimizacija l KOmpromisno Resenje method (the Serbian name of VIKOR) means multi criteria optimization and compromise solution. It is a multi criteria decision making method developed in 1990 by Serafim Opricovic to solve decision problems with conflicting criteria. This method ranks alternatives and determines the compromise solution that is the closest to the “ideal”. Regarding the rapid growth of use of VIKOR among practitioners, more than 200 scholarly papers and conference proceedings have subjected VIKOR as one of the brilliant techniques and/or combined with other MCDM methods (Opricovic, 2011; Kang, 2014).

The study analyzes 198 scholarly papers published in 116 Journals and international conference proceedings since 2002 which have been searched by the relevant databases. The collected articles at first were divided to application category and non-application area, and then those will be classified into specific areas as: Journal/conference name, applications, publication year, combining other MCDM/ MCDA methods into VIKOR, applying with fuzzy approach and distinct keywords associated by VIKOR. One objective of the study is to declare the most interesting application area of VIKOR; moreover the authors are concentrating to introduce the combined methods into VIKOR.

After this brief introduction as section 1, the paper represents VIKOR mathematical procedure and background in section 2. The research methodology that used for the review of literature and process of articles categorization are described in section 3. Then, section 4 discusses the VIKOR application areas. VIKOR non-applied publications are summarized in section 5. Distribution of papers by journals, publication year and combined methods by VIKOR are showed on section 6. Conclusion and advice for future works are discussed in part 7.

VIKOR HISTORY AND METHODOLOGY

VIKOR method includes a multi criteria optimization of complex systems that focuses on ranking and selecting from a set of alternatives among conflicting criteria. Its role is to find multi criteria ranking index base on particular measure of closeness to the ideal solution (Opricovic, 1998). It helps to solve MCDM problems regarding its two advantages; the first that it provides a maximum group utility of the majority and a minimum of the individual regret of the opponent (Opricovic, 2004). The compromise ranking of VIKOR has the four steps that \( n \) and \( m \) are the number of criteria and alternatives, respectively. The mathematical procedure is presented in Figure 1. Step 1 and 2 finds utility measure and regret measure for alternatives.

LITERATURE REVIEW FRAMEWORK

To identify papers and make a proper framework for this literature review, the authors have provided a figurative scale. Also, to detect the papers and research articles both in journals and conference proceedings, an extensive search for the VIKOR topic in the title, keywords and abstract of papers has been done. Hence, the study has undertaken to select the most valuable articles in top-rated journals and library databases searched via Emerald, IEEEExplore proceeding, Inderscience, Science direct, Springer, Tyler and Francis and Wiley publications covering all related contents in management, business science and operation research applied in various field of knowledge.
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