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Multi-Criteria Decision Making Approach: A Case Study of Team Leader Selection in IT Sector

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Abstract: **The high usage of the software in all aspects of life leads to the speedy software development with better quality with the fulfillment of time constraints also. To achieve this development goal, the concept of "working in team" has been widely adopted by the various small and large scale organizations. In this concern, it become crucial to select a person that must be capable to handle all types of activities like leadership, team management, development etc. with-in the team. In the present research, a multi-criteria decision making (MCDM) approach namely, VIseKriterijumska Optimizacija I Kompromisno Resenje (VIKOR) that is based on the calculation of the fitness value for each alternative against a set of identified selection attributes. This study produces ranking of the team leaders that will surely help the decision makers to select the right person for the position of team leader.**

Keywords: **Team leader; Multi-criteria decision making (MCDM); VIKOR; Ranking**

I. INTRODUCTION

The idea to work in a team is highly recommended now a day for the software development that helps the developers to produce high quality software with minimum effort [1-4]. Therefore, selecting the members of the team, particularly team leader seems to be very critical for timely completion [5-6]. Tseng et al. [7] disscussed the capabilities of a team leader for deciding the work flow to minimize development time and well use of all team members towards the accomplishment of the main goal. The major role of a team leader in the project development is to give the instructions to other members for the efficient organization of work so that everyone can contribute his best for the timely completion [8]. In the contemporary work, Rutherfoord [9] argued on the team leader's personality that manage disagreements, call meetings and interface with organization's authorities at both levels. Palmer and Summers [10] discussed the leadership importance in undergraduate projects and suggested that the wrong team formation can produce hazardous results by affect various attributes like confidence and communication among the members and the project outcome also. Deniz and Metin [11] recommended that the problem of team leader selection may involve a number of selection attribute. So, this problem can be well thought-out as a multi-criteria decision making problem (MCDM). A lot of selection attributes such as personality, academic achievement, teamwork experience, programming skills etc. and MCDM methods like analytical hierarchy process (AHP) were implemented by the various researchers to solve the team leader selection problem [12-16]. The right selection of team leader is highly required because incorrect selection can result in the project failure [17-19]. The present study is based on the concept of the representation of team leader selection problem as an MCDM problem and a novel MCDM approach namely VIseKriterijumska Optimizacija I Kompromisno Resenje (VIKOR) is proposed. The rest of the paper is organized as: section-2 describes the research methodology adopted, description of the selection attributes and proposed approach whereas an empirical study is provided in section-3 to show the applicability of the proposed VIKOR method. Section-4 covers the results and conclusion of the present research is provided in section-5 of the paper.

II. RESEARCH METHODOLOGY

The present research emphasizes on the development of an MCDM approach for the team leader selection for IT sector. The empirical study includes 4-team leaders, 4-selection attributes and 1-MCDM approach, namely VIKOR. This section gives the description of the proposed method, selection attributes and MCDM approach.

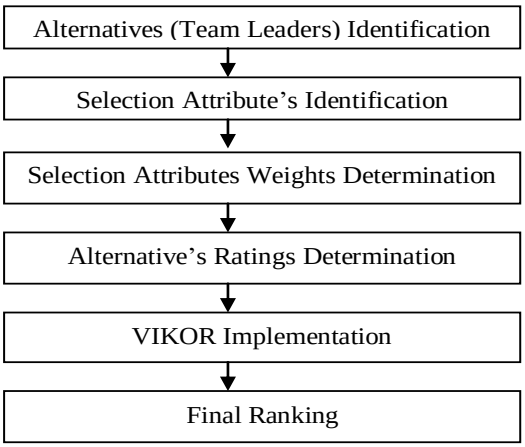

Fig. 1. Selection Procedure Adopted in this Research

MCDM approach for team leader selection

Quality assessment of the team leader is one of the elementary questions that must be addressed in team leader selection process. Although it is very difficult because of lack of objective measures to evaluate, it is of great importance for successful timely completion of any software project. This research paper develops comprehensive selection procedure as provided in Figure

TABLE I
SELECTION ATTRIBUTES DESCRIPTION

Selection Attributes	Description	Weights
Personality (A1)	Qualities exhibited by an individual showing his/her uniqueness.	0.54
Academic Achievement (A2)	Individual's educational success.	0.13
Teamwork Experience (A3)	Capability to work efficiently and effectively in a group.	0.27
Programming Skills (A4)	Ability to write codes for any software project.	0.06

Selection attributes

The main emphasis of the present research is to model the team leader selection problem as an MCDM problem. So, to get a comprehensive selection, the empirical study taken in this study includes 4-selection attributes as Personality, Academic achievement, Teamwork experience and Programming skills. The brief description of these selection attributes with their weights is given in Table 1.

MCDM approach

A variety of MCDM approaches have been developed by the various researchers in the past and widely accepted to solve many problems such as inventory policies, E-learning website selection, software engineering metrics selection, vendor selection, COTS selection etc. [20-30]. VIKOR method was provided by Opricovic in 1998 and also known as a compromise ranking method [31]. This method determines the solution that is nearest to the ideal solution. VIKOR method is based on the multi-criteria optimization of complex problems. The main motive of VIKOR method is to find out the positive and negative solutions. The positive solution means the best value of alternatives against the index and negative solution means the worst or least value of alternatives. The steps involved in the VIKOR method are presented below:

Step 1: Create the performance rating matrix (P_{ij}) and then, calculate the best and worst values for all the indexes by using the Eq. (1) and Eq. (2).

$$P_{ij} = \begin{bmatrix} p_{11} & p_{12} & \cdots & p_{1n} \\ p_{21} & p_{22} & \cdots & p_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ p_{m1} & p_{m2} & \cdots & p_{mn} \end{bmatrix}$$

$$B_j^{+} = \max_i P_{ij} \quad (1)$$

$$B_j^{-} = \min_i P_{ij} \quad (2)$$

Step 2: Calculate the utility measure (U_i) and regret measure (R_i) for all the alternatives by using the following Eq. (3) and Eq. (4).

$$U_i = \sum_{j=1}^{n} [w_j (B_j^{+} - P_{ij}) / (B_j^{+} - B_j^{-})] \quad (3)$$

$$R_i = \max_j [w_j (B_j^{+} - P_{ij}) / (B_j^{+} - B_j^{-})] \quad (4)$$

where i = 1, 2,……, m : no. of alternatives, j = 1, 2, ……., n: no. of indexes and w_j is the weight of j^{th} index.

Step 3: Next, compute the gaps (S_i) for all the alternatives by using the Eq. (5), where

$U^{+} = \min_i U_i$, $U^{-} = \max_i U_i$, $R^{+} = \min_i R_i$ and $R^{-} = \max_i R_i$. In this research, the value of v is set to 0.5 where v and (1-v) is the weight for the group utility and individual regret.

$$S_i = v\left[\frac{(U_i - U^{+})}{(U^{-} - U^{+})}\right] + (1-v)\left[\frac{(R_i - R^{+})}{(R^{-} - R^{+})}\right] \quad (5)$$

Step 4: Now, rank the alternatives by sorting the values of U_i, R_i and S_i in decreasing order. Finally, we get the three ranking lists, i.e. U_i, R_i and S_i.

Step 5:

TABLE II
RATINGS OF TEAM LEADERS AGAINST SELECTION ATTRIBUTES

Team Leader	A1	A2	A3	A4
A	0.46	0.44	0.47	0.41
B	0.27	0.29	0.28	0.29
C	0.10	0.15	0.16	0.19
D	0.17	0.12	0.10	0.06

Propose as a compromise solution; alternative (a_1) ranks at the first position by S_i (min) if following two given conditions are fulfilled:

Condition-1: Acceptable advantage

$$S_i(a_2) - S_i(a_1) \geq AS_i \quad \text{where} \quad AS_i = 1/N - 1$$

where (a_2) is the alternative with rank-2 in the ranking list by Si and N is the number of alternatives.

Condition-2: Alternative (a_1) is stable within the decision-making process, i.e. alternative (a_1) is also ranked at 1 by U_i and R_i. If one of the above conditions will not fulfill properly, then a set of compromise solutions is proposed that mainly consists of:

TABLE III
RANKINGS OF TEAM LEADERS USING VIKOR

Team Leaders	U_i	R_i	S_i	Rank
A	0.000	0.000	0.000	1
B	0.505	0.285	0.538	2
C	0.922	0.540	1.000	4
D	0.895	0.435	0.888	3

(1) If condition-2 is not fulfilled, then the alternatives (a_1) and (a_2) are compromise solutions.
(2) If condition-1 is not fulfilled, then the alternatives a_1, a_2,……,a_m are compromise solutions where am is determined by this relation $S_i(a_m) - S_i(a_1) < AS_i$ for maximum m. Finally, the alternative is ranked on the basis of S_i value; the alternative having the minimum value of S_i ranks at the first position.

III. EMPIRICAL STUDY

The empirical study is carried out to validate the proposed VIKOR method for the selection of team leaders. A data set including four team leaders by considering four selection attributes was selected in this research [32]. The ratings of 4-leaders are provided in table 2 given below.

At the first step of VIKOR implementation, the decision rating matrix is formed as given here.

$$P_{ij} = \begin{bmatrix} 0.46 & 0.44 & 0.47 & 0.41 \\ 0.27 & 0.29 & 0.28 & 0.29 \\ 0.10 & 0.15 & 0.16 & 0.19 \\ 0.17 & 0.12 & 0.10 & 0.06 \end{bmatrix}$$

After the formation of decision rating matrix, the final rankings are obtained for the team leaders using eqs. 1-5 and are given in table 3.

IV. RESULTS

In the present study, an MCDM approach namely VIKOR has been applied and demonstrated for the selection of team leader. The major findings of this research are discussed here. According to VIKOR, the alternative having minimum fitness value will be placed the first position i.e. rank -1 and the alternative having maximum value will occupy the last position i.e. rank -4. The rankings of the team leaders obtained from VIKOR provided in table 3 depicts that the team leader –A has occupied the first rank having the minimum fitness value (0.000) and the team leader –C has occupied the last position i.e. rank -4 having maximum fitness value as (1.000). The graphical representation of these rankings is also provided in figure 2.

V. CONCLUSION

The present research provides the step-wise procedure for the team leader selection in IT sector by implementing Visekriterijumsko Kompromisno Rangiranje (VIKOR) approach that is based on the value closest to ideal solutions. The team leader selection process framework developed in this study can be used to solve the present problem i.e. team leader selection by the decision makers to made a precise selection. The proposed approach takes a lot of advantages over the existing MCDM approaches such as consideration of priority weights of selection indexes, less complexity, easy to implement etc. This work can be further extended in various aspects such as more selection attributes consideration and their interdependence.

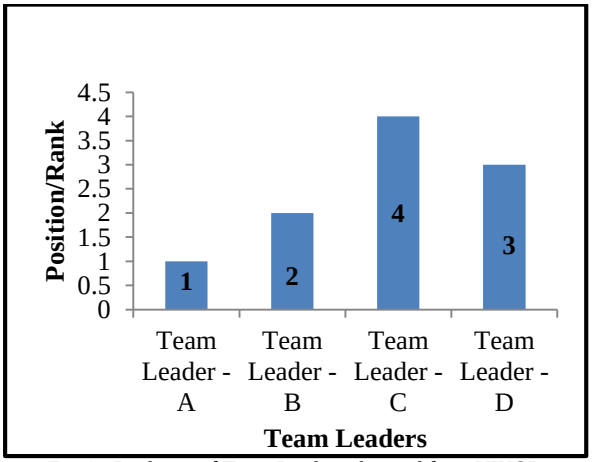

Fig. 2. Rankings of Team Leaders obtained from VIKOR

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