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Study on the Selection of New Members of the University Students' Union from the Perspective of Group Decision-Making

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Abstract

Group decision-making is a process in which multiple people participate and make decisions. It is an excellent way to collect wisdom for scientific decision-making. In recent years, international scholars have made outstanding achievements on this topic, but there is still a gap between theory and reality. In addition, it remains a research area for the application of group decision models. This article focuses on applying the group decision model to recruiting new members of the university student union. Taking 2021 recruiting of the Academic Division of the School of Business Administration of Zhongnan University of Economics and Law as an example, it constructs an empirical model and gives an overview of the research. At the same time, the attributes and decision-makers are double-weighted. By using the improved TOPSIS ranking method, a comprehensive ranking is obtained. This is a more scientific method than subjective judgment and challenging decisions. This article used structured interviews and scoring methods to obtain raw data and then constructed models and sorted these data using the TOPSIS method. The article is divided into four sections: the first section discusses the design of interview questionnaires and interview schedules; the second section introduces the fundamental theories of group decision-making, the standardization of interval numbers, the selection model, and the TOPSIS method; and the third section conducts empirical research. The fourth section provides an analysis of the results and recommendations.

Keywords

Student Union, Recruitment, TOPSIS Method, Interval Numbers

1. Introduction

Due to the different cognitive perspectives and decision-makers' abilities, decision-making results are frequently different. Thus, obtaining a uniform, objective, and accurate standard is not easy. In group decision-making, each person usually makes his or her own choice first, and then the results are put together to form a final opinion or result.

Accepting new members from the outside is known as recruitment. Members' quality is determined by how formal and strict the recruitment process is. When faced with the difficult decision of selecting new members, the student organization must quickly collect information during the interview, conduct an accurate and timely evaluation of each candidate, and assemble a review panel to complete the selection process. Different decisions can be made depending on how the panel members are given power and the characteristics of the chosen candidates.

Therefore, the selection of student organization members is a typical multi-attribute group decision problem. It is crucial to conduct scientific research on this issue. In addition, the attribute values in the standard group decision-making model are typically accurate. However, these characteristics are not always accurate in practice; therefore, this study examined this issue using interval numbers. Furthermore, much research has not been conducted on how student organizations choose their members at home and abroad, making this an excellent research topic of great importance.

2. Literature Review

Most current research in group decision-making focuses on linguistic multi-attribute, intuitionistic fuzzy multi-attribute and hybrid multi-attribute group decision-making. Tao (2015) proposed a new algebraic operation based on the trigonometric norm to overcome the existing linguistic information definition of binary semantic variables, uncertain linguistic variables, and the tightness of algebraic operations in linguistic information. Zhang (2015) proposed a multi-attribute group decision-making method based on multi-criteria compromise ranking with unknown attribute weights. The intuitionistic fuzzy weighted average operator was used to integrate all individual decision information to obtain group decision information. The entropy weight of the property was calculated using the intuitionistic fuzzy numbers' entropy formula. The solutions were then ranked and chosen using the basic idea of the traditional VIKOR method and the intuitionistic fuzzy numbers' distance metric. Yang et al. (2014) proposed a new multi-attribute group decision method in a fuzzy environment using multi-attribute weight information. To determine different weights for each decision maker based on different attributes, they used a fuzzy approximate ideal solution (FTOPSIS). The attribute weights were then determined using a linear programming model, and the alternatives were ranked using the FTOPSIS method. Han et al. (2016) proposed a multi-attribute group decision-making method that integrates subjective and objective weights and an extended multi-criteria coordinated optimization scheme (VIKOR) for multi-attribute group decision-making problems with varying granularity and linguistic characteristics.

Feng and Wang (2021) proposed a method for determining expert weights and attribute weights based on coordinated optimization for domestic research on group decision weights. Fine-tuning was done in stages until all data was input to determine attribute weights for each input method. Finally, the expert and attribute weights are calculated. Song and Lin (2016) proposed a combined weight method based on deviation maximization to solve the integrated weights of attributes with unknown attribute weights, decision-maker weights, and fixed attribute values. Han et al. (2016) proposed a multi-attribute group decision-making method based on subjective and objective weights and an extended multi-criteria coordinated optimization scheme (VIKOR). Xu (2015) suggested a ranking scheme for interval-type multi-attribute decision-making based on likelihood degree.

Different decision-makers attribute weights determine how close candidates are to their ideal. Differences in decision-maker authority determine the ideal point of candidates close to the group, and candidates are ranked accordingly. There are few international studies on this topic. Pankaj et al. (2016) expanded the traditional VIKOR method to solve multi-attribute group decision-making in fuzzy environments. It involves weighing conflicting attribute-based alternatives based on the decision maker's hazy assessment. PLS problems demonstrate the applicability of this decision-making method. A review of related literature shows that this topic has more research space and more profound implications for research.

3. Overview of issues

This paper used the Academic Division in the College of Business Administration of Zhongnan University of Economics and Law as an example. The Academic Division is led by the president, the vice president, and the officers. Preparation, mid-term interviews, and end-stage work are parts of the recruitment process. Preparing the recruitment plan, submitting it to the college for review, conducting online and offline promotion work, and reserving a venue for recruitment are all part of the preparation process. Generally, the midterm interview involves collecting application forms and conducting the first round of interviews on-site, the second round of group interviews for those who pass the first round, and the third round based on each division's needs. The first round of interviews usually consists of face-to-face communication to understand the situation and assess communication skills. The second round of interviews usually divides candidates into small groups to discuss the topic on the spot, which examines teamwork skills.

The author chose the president, the vice president, and two officers of the Academic Division to act as inter-

viewers for this study. Through research and consultation, the author obtained the contact information of members of the academic division and kept their basic information confidential to protect their privacy and security. The author created a detailed interview schedule and kept track of the outcomes. First, the author obtained communication records of the fall 2021 recruiting process, including the presentation and recording of personal qualities during interviews. Second, telephone interviews were conducted in the recruitment interviews to understand the academic division's requirements for new members. The records were then compiled to summarize the essential aspects of the recruitment interviews and selection process. Ten interviewees were chosen randomly to determine their performance in the first and second rounds of interviews. The results of the two interviews were combined to form a composite interview score. A comprehensive scoring scale was developed based on the relevant attributes. Since this study was conducted in the autumn of 2021, there was some delay and ambiguity in the recruitment process. Consequently, the scoring scale was designed as an interval index. The scores of two randomly selected vice presidents were used as the base data due to the complexity of the data and interviews. In practice, the weighting method could be adjusted based on the actual number of participants and the seniority of the positions. The ten interviewees were ranked using the TOPSIS method based on the data in the scoring table, and the selection was made case by case. Finally, the findings were assessed and analyzed to make recommendations.

4. Research Design

4.1 Design of the interview questionnaire

The interview questionnaire was created for vice presidents directly involved in the recruitment process to understand their direct perception of the interviewees' qualities during the recruitment process. The questionnaire was also given to presidents and officers to determine what qualities they were looking for in recruits based on their experience. The questionnaire included both open-ended and closed-ended questions. The open-ended questions focused on the new members' qualities, and the closed-ended questions focused on their assessment of the current situation and intentions.

4.2 Design of the scoring form

Since this paper is based on the decision maker's subjective evaluation, it is not easy to handle quantitatively, so the scoring method is more appropriate. The scoring method converts qualitative research into quantitative research. First, it selects multiple evaluation items based on the specific requirements of the target, then it develops evaluation criteria, creates a scoring table, assigns evaluation scores, participates in the evaluation criteria, and finally collects the scoring results. Based on the above interview questionnaire results, the study summarized the five qualities most needed by student organizations: organizational, practical, communication, cooperation and thinking skills. The scoring criteria were determined in a customizable interval format to make it easier for the scorers. The points were assigned to four levels: ‘Excellent’ represented [90,100], ‘Good’ represented [80,90], ‘Medium’ represented [70,80], and ‘Poor’ represented [60,70]. Ten interviewees were chosen randomly for evaluation (students 1-10), and the president, vice president and two officers were given a score sheet. The average scores for each attribute were chosen and recorded as raw data. Different weights were assigned to the five attributes based on their perceptions of the new members' quality indicators.

4.3 Group Decision Model Construction

Complex multi-objective semi-structured and unstructured decision problems are the focus of group decision-making. It entails multiple decision-makers in a group with varying preferences making confident choices. The nominal group method, Delphi method, dialectical inquiry method, devil's advocate method, and multi-attribute analysis method are standard group decision-making methods. The shift from individual to group decision-making is significant.

4.3.1 Overview of the member selection model

Assume that there are s decision-makers in the decision-making group, denoted as D={ D_1, D_2,...,D_s }, k = 1,2 ,…, s;

The candidates $C = \{C_1, C_2, ..., C_n\}$, $i = 1, 2, ..., n$;

The attributes A_j to be examined are 'm', denoted as $A=\{A_1,A_2,...,A_m\}, j=1,2,...,m$.

Use a_{ij} to denote the value of candidate C_i under attribute A_j, and use $\tilde{a}_{ij}=[a_{ij}^L,a_{ij}^U]$ to denote the number of candidate C_i intervals under the attribute A_j to form the decision matrix $\tilde{A}$ and $\tilde{A}=[\tilde{a}_{ij}]_{n\times m}$.

Members of the decision-making group are composed of principals with different authorities and should therefore be given different weights. Use ω_k to indicate the weight of the decision maker D_k, $\omega=\{\omega_1,\omega_2,...,\omega_s\}$, $0\le\omega_k\le 1$, and $\sum_{k=1}^{s}\omega_k=1, k=1,2,...,s$.

4.3.2 TOPSIS Method

After being first proposed in 1981, the Approximation of Ideal Points (TOPSIS) method has been widely used in various decision-making fields due to its simple algorithm and intuitive and reasonable decision basis.

$\widetilde{R^k}^+=(\widetilde{r_1^k}^+,\widetilde{r_2^k}^+,...,\widetilde{r_m^k}^+)$ is called the interval-type positive ideal point of the decision maker D_k, where $\widetilde{r_j^k}^+=[r_j^{k+L},r_j^{k+U}]=[\max(r_{ij}^{k+L}),\max(r_{ij}^{k+U})]$, (j=1,2,…,m;k=1,2,…,s.

$\widetilde{R^k}^-=(\widetilde{r_1^k}^-,\widetilde{r_2^k}^-,...,\widetilde{r_m^k}^-)$ is called the interval-type negative ideal point of the decision maker D_k, where $\widetilde{r_j^k}^-=[r_j^{k-L},r_j^{k-U}]=[\min(r_{ij}^{k-L}),\min(r_{ij}^{k-U})]$, (j=1,2,…,m; k=1,2,…,s).

Set the number of intervals as $\tilde{a}=[a^L,a^U],\tilde{b}=[b^L,b^U]$

If $\left\|\tilde{a}-\tilde{b}\right\|=\left|b^L-a^L\right|+\left|b^U-a^U\right|$, and $d(\tilde{a},b)=\left\|\tilde{a}-\tilde{b}\right\|$ is called the interval number of phase deviation.

Calculate the divergence of the candidate from the positive and negative ideal points of the decision maker in turn defined as follows:

$$d_i^{k^+}=\sum_{j=1}^{m}\left\|\widetilde{r_{ij}^k}-\widetilde{r_j^k}^+\right\|=\sum_{j=1}^{m}[\left|r_{ij}^{k^L}-r_j^{+L}\right|]+\left|r_{ij}^{k^U}-r_j^{+U}\right|](k=1,2,...,s;i=1,2,...,n)$$

$$d_i^{k^-}=\sum_{j=1}^{m}\left\|\widetilde{r_{ij}^k}-\widetilde{r_j^k}^-\right\|=\sum_{j=1}^{m}[\left|r_{ij}^{k^L}-r_j^{-L}\right|]+\left|r_{ij}^{k^U}-r_j^{-U}\right|](k=1,2,...,s;i=1,2,...,n)$$

For the decision maker D_k, H_i^k is called the proximity of the candidate C_i relative to its ideal point, where

$$H_i^k=\frac{d_i^{k-}}{d_i^{k+}+d_i^{k-}},\quad i=1,2,...,n;k=1,2,...,s.$$

This constitutes the proximity matrix H of the candidate population relative to the ideal point of the individual decision maker, $0\le H_i^k\le 1$ If the candidate C_i is a positive ideal solution for the decision maker D_k, there is $H_i^k=1$; if the candidate C_i is a negative ideal solution for the decision maker D_k, there is $H_i^k=0$; the closer the candidate is to the positive ideal solution and away from the negative ideal solution, the H_i^k is greater. The goal of the decision panel is to select the candidate C_i.

5. Empirical Research

5.1 Data Analysis

The study obtained ten valid questionnaires and interview records from the ten interviewees. In the interview questionnaires, eight people chose the cooperation skill, eight people chose the communication skill, six people

chose the organizational skill, five people chose the practice skill, and four people chose the thinking skill. In the telephone interview, nine people mentioned the cooperation skill, eight mentioned the communication skill, seven people mentioned organizational skill, and six mentioned the skill of practising and thinking. Other mentioned competencies included learning skill, skill to obtain information and resources, and endurance ability, but they were not taken into account due to their lower frequency of mention.

Based on the importance of the competencies as ranked in the questionnaire and interviews, a weighting table was created as follows. The decision-makers original data was assigned different weights.

The author obtained the original data for the ten interviewees based on the returned scoring sheets. The average of all the scoring sheets was used to determine the student's ability scores according to the four set intervals.

5.2 TOPSIS Sorting Procedure

The five cost-based attributes of the study are organizational, practical, communication, cooperation, and thinking skills.

Table 1. Decision maker weights and decision makers' assigned values for attributes

k	ω_k	λ_1^k	λ_2^k	λ_3^k	λ_4^k	λ_5^k
1	0.35	0.15	0.25	0.3	0.1	0.2
2	0.25	0.18	0.16	0.21	0.19	0.26
3	0.2	0.22	0.15	0.25	0.23	0.15
4	0.2	0.19	0.17	0.21	0.20	0.23

Table 2. Raw data for students 1-10 proficiency scores

Student	Organizational skills	Practical skills	Communication skills	Cooperation skills	Thinking skills
1	[74,84]	[75,85]	[81,91]	[83,93]	[80,90]
2	[77,87]	[72,82]	[69,79]	[68,78]	[70,80]
3	[62,82]	[78,88]	[67,77]	[66,76]	[65,75]
4	[71,81]	[70,80]	[71,72]	[70,80]	[81,91]
5	[72,82]	[75,86]	[67,68]	[63,73]	[73,83]
6	[83,93]	[90, 100]	[89,99]	[70,80]	[87,97]
7	[76,86]	[81,91]	[87,97]	[84,94]	[85,95]
8	[78,88]	[86,96]	[70,80]	[87,97]	[79,89]
9	[70,80]	[70,80]	[63,73]	[65,75]	[81,91]
10	[81,91]	[79,89]	[83,93]	[90,100]	[78,88]

Table 3. Decision Specification Matrix

Student No.	Organizational skills	Practical skills	Communication skills	Cooperation skills	Thinking skills
1	[0.28,0.36]	[0.27,0.35]	[0.3,0.38]	[0.31,0.39]	[0.29,0.36]
2	[0.29,0.37]	[0.24,0.33]	[0.26,0.33]	[0.25,0.33]	[0.25,0.32]
3	[0.23,0.31]	[0.28,0.36]	[0.25,0.32]	[0.25,0.32]	[0.23,0.3]
4	[0.27,0.34]	[0.25,0.32]	[0.26,0.34]	[0.26,0.34]	[0.29,0.37]
5	[0.27,0.35]	[0.27,0.35]	[0.25,0.32]	[0.23,0.31]	[0.26,0.34]
6	[0.31,0.39]	[0.32,0.41]	[0.33,0.42]	[0.26,0.34]	[0.31,0.39]
7	[0.28,0.36]	[0.29,0.37]	[0.32,0.41]	[0.31,0.4]	[0.3,0.38]
8	[0.28,0.37]	[0.31,0.39]	[0.26,0.34]	[0.32,0.41]	[0.28,0.36]
9	[0.26,0.34]	[0.25,0.32]	[0.23,0.31]	[0.24,0.32]	[0.29,0.37]
10	[0.3,0.39]	[0.28,0.36]	[0.31,0.39]	[0.33,0.42]	[0.28,0.36]

Since each decision-maker has a different understanding, different weights were assigned to each attribute by aggregating decision makers' opinions. The four decision makers' weighted normalized matrices are obtained separately for the interval-type positive and negative ideal points. The distance between the individual positive and negative ideal points, and the proximity to the decision makers' ideal points were all obtained and combined. The results are shown as follows.

Table 4. Proximity table for each decision maker

Student No.	President	Vice President	Officer 1	Officer 2
1	0.591	0.636	0.645	0.63
2	0.267	0.301	0.326	0.308
3	0.196	0.144	0.147	0.151
4	0.346	0.418	0.344	0.394
5	0.236	0.261	0.234	0.254
6	0.803	0.709	0.667	0.694
7	0.778	0.791	0.78	0.78
8	0.518	0.604	0.594	0.611
9	0.249	0.339	0.235	0.312
10	0.692	0.726	0.782	0.737

The results are H_G^+ = (0.2811，0.1978，0.1565，0.1561) and H_G^- = (0.0686,0.0360,0.0293, 0.0302)

The distance and proximity of the ten interviewees to the group's ideal point were calculated, and the proximity was the same as in the previous calculation. Finally, as shown in table 5, the final ranking of the candidates was obtained by ranking the results in order of magnitude, with the higher ranking being preferred.

Table 5. Overall Ranking

Student No.	Distance to the ideal positive point	Distance to the ideal negative point	Proximity	Final Ranking
1	0.0930	0.2311	0.7131	4
2	0.2596	0.0666	0.2042	7
3	0.3214	0.0000	0.0000	10
4	0.2189	0.1066	0.3276	6
5	0.2830	0.0421	0.1295	9
6	0.0353	0.2962	0.8936	2
7	0.0088	0.3155	0.9730	1
8	0.1212	0.2059	0.6295	5
9	0.2667	0.0637	0.1928	8
10	0.0430	0.2850	0.8688	3

The modified TOPSIS interval method results revealed that Interviewer 7 had the most excellent proximity and ranked first, indicating that Interviewer 7 was the best choice for the academic division. The distance and proximity of Interviewer 3 to the ideal negative point are zero, indicating that the study has an intuitive worst-case scenario consistent with Interviewer 3's low scores. This means that of the ten students interviewed, Interviewer 3 was the worst performer and the worst choice for the academic division. Decision-makers and attributes are weighted twice in this TOPSIS ranking. The number of intervals determines the information's timeliness. The exact number can be used to score in an actual interview, simplifying the calculation.

By ranking the students, we can prioritize the students to be interviewed and provide a reference for the selection of students to the university student government, which is also applicable in the case of more candidates. The method described in this paper is intuitive, simple, easy to operate, and suitable for college student unions, which involve many candidates, many evaluation attributes, and the uncertainty of decision makers' judgment. It is more scientific than the subjective selection method commonly used by college student unions. However, the method is too mechanical, and many different ways of empowerment will produce different results. It is worthwhile to further research and explore how to assign weights scientifically. In addition, using interval numbers improves the accuracy, but the calculation process is tedious, which is worth further optimization and improvement.

6. Recommendations

The process and principles of new member recruitment significantly impact the quality of new members. After reviewing the literature, some recommendations for recruiting new members are proposed.

The group should conduct an internal analysis before recruiting. Staffing requirements and job descriptions should be defined clearly by reviewing the previous year's work and considering the organization's future development plan. The capabilities required of each job holder have to be well-defined. Candidates' abilities and the position requirements must be aligned during the recruitment process to achieve the best match. So that human resources can be adequately allocated. It is also crucial to train examiners and make reasonable a question set be fore the interview. The union must create a relaxed environment for the candidates to reduce tension and help them reach their most realistic level.

The performance and evaluation of the interviewers should be documented as soon as possible. In addition, all materials submitted by the applicant should be kept in a secure location during the recruitment process. Accepted members' files are classified based on their affiliated divisions. Files of rejected candidates are classified based on their job preferences and ranked by their fitness level. It is to enrich data and form an organization's HR database. When the need arises, the union can quickly identify relevant can did at esand contact them. This significantly reduces the recruiting time and responds to emergencies where members are unavailable and unsuitable. It also lowers the risk of human resources and improves their efficiency.

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