CLASSIFICATION OF VOLUNTEERS FOR SEARCH AND RESCUE ACTIVITIES TO ASSIGNMENT IN HUMANITARIAN ORGANIZATIONS USING INTEGRATED AHP AND TOPSIS SORT METHOD

ABSTRACT

Volunteers constitute an important part of public and private organizations operating in many fields. Organizations plan to select the most suitable volunteers for their institutions within the framework of the criteria they have determined according to their needs. If the appropriate volunteer selection is not made, the volunteer may not continue and the work of the institution can be disrupted.

In this study, a student group consisting of volunteers for search and rescue activities in humanitarian organizations is classified according to certain criteria before assigning a task. For this, criteria are determined based on previous studies. Later, the criteria weights are obtained by applying the AHP method, and then our volunteers will be classified using the TOPSIS SORT method. The findings obtained as a result of our study are evaluated and suggestions are made for future research.

Keywords: Volunteer selection, Classification, search and rescue, AHP, TOPSIS SORT

1. Introduction

Volunteers make many contributions to different organizations in a country, both economically and socially. These organizations need human resources and to use them in the best way, however, their management is different compared with professionals. Volunteers are often unpaid workers and their numbers are unpredictable. The organization needs to use its volunteers as efficiently as possible. Therefore, creating a pool of volunteers and dividing them into different groups based on their knowledge is beneficial to reduce the time and complexity of selecting volunteers.

2. Literature Review

Endo and Sugita (2010) suggested the classification of volunteers to prevent chaos during disaster recovery and to increase the effectiveness of the work done. The volunteers were divided into 4 groups: expert, experienced, inexperienced, and trouble-making, according to their skills. They recommended removing the trouble-making group from disaster recovery activities.

Lassiter et al. (2014) examined the issue of volunteer training and the assignment of volunteers under various demand scenarios. Their results suggested that although it is inevitable to use an expert staff consisting entirely of volunteers in high-risk and emergencies, matching other volunteers with expert staff for training is needed.

Urrera et al.(2019) studied a charity storehouse that runs entirely on volunteers` efforts. They observed two types of volunteers arriving at different times at the storehouse: Experienced (Exp) and Inexperienced (Inexp). It was designed with 32 (4*2*4) experimental treatments according to the volunteer experience, and storehouse congestion policies(allow and impede congestion) in four conditions(steady, high supply, high demand, high supply, and high demand). Their results showed that on average, mix-pairing(Exp-Inexp) is better than no-mixed pairing in steady conditions.

3. Hypotheses/Objectives

This study aims to classify volunteers using integrated AHP and TOPSIS SORT methods for volunteer selection. As a case study, a questionnaire containing the criteria determined after the AHP method is applied to the student group of the Department of Emergency Disaster Management of Munzur University. The aim is to fill the gap in the literature on voluntary classification with integrated AHP and TOPSIS SORT.

4. Research Design/Methodology

In the first part of the study, as a result of the literature review, criteria are determined according to the needs of the institutions carrying out search and rescue activities. The AHP method is applied to find the criterion weights. Then, each class range is determined and the Topsis SORT method is applied according to the data obtained from the student questionnaire results.

5. Data/Model Analysis

Table 1 compares the characteristics of the person who is suitable for search and rescue activities among themselves by preference scale. The criteria weights obtain when the AHP method (Saaty, T. L. (1988)) is applied are shown in Table 2. The consistency ratio of our criteria is calculated (CR is equal to 0.045<0.10) and it is seen that our data are usable.

Pairwise matrix	p1	p2	p3	p4	p5
First Aid knowledge (p_1)	1	3	5	5	3
Search and Rescue knowledge (p_2)	0,33	1	5	3	1
Computer knowledge (p_3)	0,2	0,2	1	0,33	0,2
Aptitude for teamwork (p_4)	0,2	0,33	3	1	0,33
Learning Ability (p_5)	0,33	1	5	3	1

Table 1: Comparison matrix of personal characteristics

Normalize Matrix	p1	p2	p3	p4	p5	Criteria weight
First Aid knowledge (p_1)	0,485	0,542	0,263	0,406	0,542	**0,448**
Search and Rescue knowledge (p_2)	0,160	0,181	0,263	0,243	0,181	**0,206**
Computer knowledge (p_3)	0,097	0,036	0,053	0,027	0,036	**0,050**
Aptitude for teamwork (p_4)	0,097	0,060	0,158	0,081	0,060	**0,091**
Learning Ability (p_5)	0,160	0,181	0,263	0,243	0,181	**0,206**
C1	0,403	0,165	0,037	0,068	0,175	
C2	0,336	0,134	0,030	0,055	0,134	
C3	0,224	0,103	0,020	0,036	0,103	
C4	0,134	0,051	0,010	0,023	0,062	

Table 2: The result of the criteria comparison by AHP with each class values

Brief information about Topsis SORT

TOPSIS SORT method, a multi-criteria ranking method first developed by Sabotkar et al., can be applied to classify and rank volunteers according to their characteristics. The main idea is to rank each alternative in comparison with each other to ensure that each class is separated. After finding the weighted normalized matrix in the Topsis method, the following steps are applied respectively.

a) Determine the positive ideal and negative ideal solutions.

$$A^+ = \{v_1^+, \ldots, v_m^+\} = \{\max_j v_{ij} | j\varepsilon J, \min_j V_{ij} | j\varepsilon J'\} \qquad A^- = \{v_1^-, \ldots, v_m^-\} = \{\min_j v_{ij} | j\varepsilon J, \max_j V_{ij} | j\varepsilon J'\}$$

b) Calculate the Euclidean distances of each alternative from the positive ideal solution and the negative ideal solution, respectively.

$$S_i^+ = \sqrt{\sum_{j=1}^{m} (v_{ij} - v_j^+)^2}, i = 1, \cdots, n \qquad S_i^- = \sqrt{\sum_{j=1}^{m} (v_{ij} - v_j^-)^2}, \ i = 1, \cdots, n$$

c) Calculate the relative closeness of each alternative to the ideal solution. The relative closeness of the alternative A_i to A^+ is defined as.

$$P_i = \frac{S_i^-}{S_i^+ + S_i^-}, i = 1, \ldots, n.$$

d) Rank the alternatives according to the relative closeness to the ideal solution: the bigger the P_i, the better the alternative A_i. The best alternative is the one with the highest relative closeness to the ideal solution

After applying the TOPSIS Sorting method, the part of sample data in Table 3 is reached. Students in the 1st class have priority in any search and rescue mission. If the number of volunteers in the first class is not sufficient, task assignments such as C2 and C3 should be made, respectively. Volunteers in the last class (C4), should be matched with the volunteers in the first group as much as possible and gain experience in steady conditions

Volunteers	S_i^+	S_i^-	P score	Class
a1	0,204	0,229	0,529	C3
a2	0,092	0,355	0,794	C2
a3	0,206	0,226	0,524	C3
a4	0,206	0,229	0,526	C3
a5	0,199	0,251	0,558	C3
a6	0,101	0,338	0,770	C2
a7	0,101	0,338	0,770	C2
a8	0,058	0,410	0,875	C1
a9	0,109	0,319	0,746	C2
a10	0,297	0,142	0,323	C4
C1	0,073	0,360	0,831	
C2	0,157	0,276	0,637	
C3	0,274	0,155	0,361	
C4	0,386	0,046	0,107	

Table 3: The result of the classification of volunteers by TOPSIS SORT

6. Limitations

The scope of the study is not very wide and is applied to the criteria determined for the institution's needs. For future studies, The number of criteria can be increased. It can be expanded and applied according to the needs of other institutions with duties in different fields. In addition, the benefit and cost, criteria can also be taken into account. In the selection of volunteers, if desired, specialist personnel wages, daily wages, or personnel training costs can be added to the cost part.

7. Conclusions

This study aims to prevent confusion and waste of time in the selection of volunteers by classifying and dividing the volunteers into groups. While determining the volunteers, it is possible to be selected from the first group to the last group, according to the criteria determined by AHP for the needs of an institution and the number of people. This classification will prevent volunteers from being assigned roles that do not match their qualifications and will provide an opportunity to match volunteers with experienced groups. For future studies, this classification can be applied by comparing it with different ranking methods such as Vikor or ELECTRE SORT with the AHP method. After the classification is done, an assignment method including time, place, and different tasks to

the volunteers, starting from the first grade, can be made with the help of a mathematical model; Volunteers can be grouped as experienced and inexperienced, and they can be matched with different groups to gain experience.

8. Key References

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9. Appendices

SURVEY

Measuring the knowledge of search and rescue activities of the volunteer team to be formed from the students of the Emergency Aid and Disaster Management Department

Dear students
This questionnaire has been prepared to measure the degree to which our department students have some of the features we have determined in search and rescue activities. The information you provide in the questionnaire will be confidential and only used for doctoral studies. Thank you for your time and contribution.

Ümit ÖZDEMİR

Name-Surname :
Age
Gender

1. How much do you know about first aid?
A) Excellent   B) Very Good   C) Good   D) Ok   E) Bad

2. How much do you know about Search and Rescue activities?
A) Excellent   B) Very Good   C) Good   D) Ok   E) Bad

3. How are your computer skills?
A) Excellent   B) Very Good   C) Good   D) Ok   E) Bad

4. How aptitude are you to teamwork?
A) Excellent   B) Very Good   C) Good   D) Ok   E) Bad

5. How is your learning ability?
A) Excellent   B) Very Good   C) Good   D) Ok   E) Bad