



# Decision making process in selection of group leader

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**ABSTRACT:** The research considers the problem of choosing the head of a student group from the point of view of decision theory. In the leadership literature, there is consensus that leadership effectiveness is associated with two basic dimensions: people orientation and task orientation. The current findings offer new insights into the way that leaders can improve team effectiveness. A method of analytic hierarchy is also proposed for its solution. The results of applying the method to several groups are considered and generalized.

**KEY WORDS:** decision making process, AHP, selection, group leader,

## I. INTRODUCTION

Theory and research concerning leadership, especially in the organizational context, suggest that leadership is an important factor that may affect work team processes and results [5],[6]. However, how leaders may improve a team's performance and effectiveness is a question that the literature has not been able to answer with precision [7]. The charter of a higher educational institution provides for the appointment of a headman in each academic group, including both full-time and part-time studies. The choice of the head of the group is a simple task at first glance. However, the wrong assignment can have dire consequences for the group - interpersonal conflicts, poor performance, removal of students from the public life of the university, etc. Thus, the choice of the headman is a responsible task, and such a choice should be justified. On the other hand, the choice of an elder is a multi-criteria and poorly structured task, therefore, some methods of decision theory can be applied to solve it. In this article, it is proposed to use the method of analytical hierarchy (Analytical Hierarchy Process) [1] as a justification for the choice when deciding on the appointment of the headman. In order to apply this method to the task of choosing a headman, you need to know the purpose, composition of the criteria, a list of alternatives.[3]

## II. METHODOLOGY

The method of analytical hierarchy consists in pairwise comparison of the criteria  $C_i$  ( $i = 1...n$ ), as well as alternatives  $A_k$  ( $k = 1...m$ ) according to the criteria using the preference relation. The results are summarized in tables of the following form tables 1 and 2.[2]

Criteria	Criteria				Vector	Weight
	$C_1$	$C_2$	....	$C_n$		
$C_2$	$C_{11}$	$C_{12}$	...	$C_{1n}$	$\delta_1$	$W_1$
$C_3$	$C_{21}$	$C_{22}$	...	$C_{2n}$	$\delta_2$	$W_2$
$C_4$	$C_{31}$	$C_{32}$	...	$C_{3n}$	$\delta_3$	$W_3$
$C_5$	...	...	...	...	....	....
$C_n$	$C_{n1}$	$C_{n2}$	...	$C_{nn}$	$\delta_n$	$W_n$

Table 1. Pairwise assessment of the criteria

Альтернатива	A	A	...	A	Vector	Weight
$A_1$	$a_{12}$	$a_{12}$	...	$a_{1m}$		
$A_2$	$a_{21}$	$a_{22}$	...	$a_{2m}$		
....	....	....	...	...		
$A_m$	$a_{m1}$	$a_{m2}$	...	$a_{mm}$		

Table 2. Pairwise assessment of alternatives for each criterion



**Fill the table cells as follows:**

$$C_{ii} = 1, \quad i, j = 1..n; \quad a_{kk} = 1, \quad k, l = 1..m.$$

1. If the criterion exceeds the importance of the criterion, then  $c_{ij} = \{1,3,5,7,9\}$  Similarly for alternatives: if it exceeds  $a_{kl} = \{1,3,5,7,9\}$ , then. Here 1 means equality, 3 - moderate superiority, 5 - significant superiority, 7 - significant superiority, 9 - very large superiority.[3]
2. For dominated alternatives, the inverse values are written:

$$C_{ji} = \frac{1}{c_{ij}}, \quad a_{lk} = \frac{1}{a_{kl}}$$

3. Calculate the values of the eigenvectors according to the formulas:

$$\delta_i = \sqrt[n]{c_{i1} * c_{i2} * \dots * c_{in}}$$

$$\gamma_k = \sqrt[m]{a_{k1} * a_{k2} * \dots * a_{km}}$$

4. The next step is to calculate the weight - the normalized value of the eigenvectors  $\delta_i$  and  $\gamma_k$ , respectively:

$$w_i = \frac{\delta_i}{\sum_{i=1}^n \delta_i}, \quad \sum_{i=1}^n w_i = 1,$$

$$v_k = \frac{\gamma_k}{\sum_{k=1}^m \gamma_k}, \quad \sum_{k=1}^m v_k = 1$$

5. Next, form a summary table of the criteria weights and calculate the integral indicator for each alternative according to the formula:

$$E_i = \sum_{j=1}^n w_j v_{ij}, \quad j = 1..m$$

6. The optimal choice is the alternative for which the integral indicator is the highest:  $E = \max_i E_i$

### III. MAIN CONTENT

Students of 2-4 courses were involved in the experiment. First-year students were not attracted due to a small acquaintance with each other at the beginning of the school year. The goal was set for the students - using the AHP method to select the headman, although at the time of the experiment in each group the headman was already appointed by order. The question arises - why then choose? Firstly, a situation is possible when the current headman is not satisfied with the students of the group, secondly, to justify the choice of the headman, thirdly, with the data received, students can go to the dean's office to change the headman's candidacy. The following criteria were proposed by criteria for the selection and comparison of alternatives for each leader.[3]

C1 - academic performance (learning "good" and "excellent" according to the results of the session, current academic performance);

C2 - sociability (the ability to find a common language with classmates and teachers);

C3 - initiative (active participation in the public life of a group, faculty, university);

C4 - organizational work (informing students and teachers, organizing and conducting meetings, monitoring the execution of assignments issued to the group).

C5 - Personality (Honesty and integrity)

Using these criteria, students select an elder for their group who will inform, coordinate, represent the interests of their group in a timely manner, and also be an example. Both experts and students acted as alternatives. The list of alternatives for each expert is formed from the list of group students by deleting the name of the expert himself, so the subjects themselves could not evaluate. This task is represented by a hierarchical diagram in figure 1. At the first level of the hierarchy, the goal is determined - to choose the headman, at the second level selection criteria are placed, in our task there are four of them. At the third level, the alternatives are the surname, name and patronymic of students from the list.

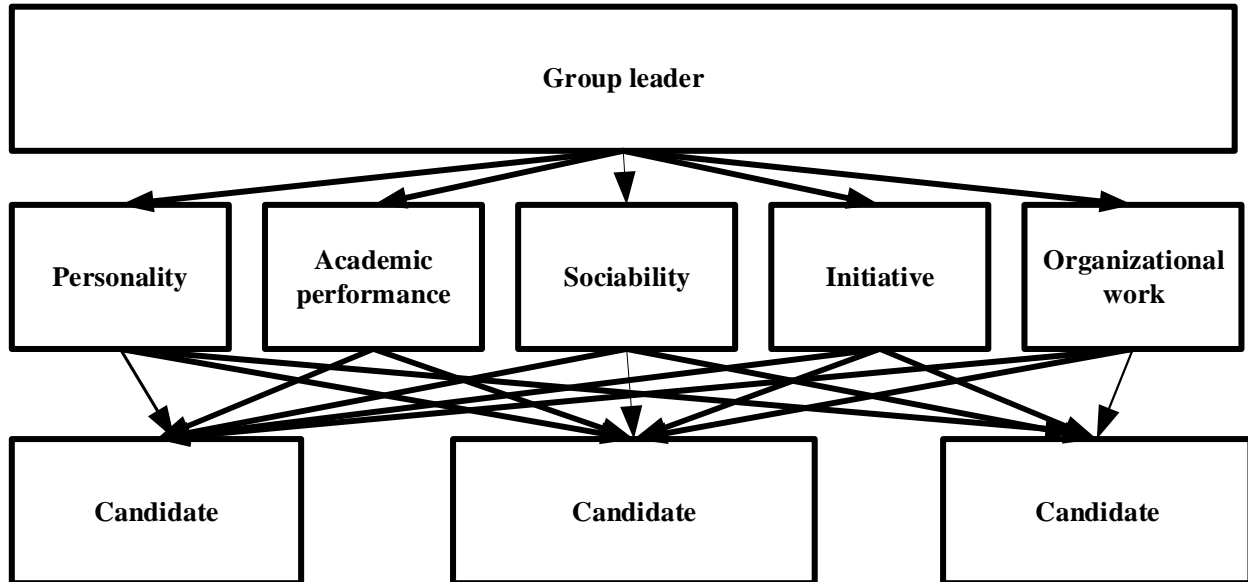


Fig.1. Pairwise evaluation of criteria by one of the experts

In order to compare the subjective opinion of a student with a certain quantitative assessment, the AHP method offers the following expert preference scale:

- 1 - equal importance;
- 3 - moderate superiority;
- 5 - significant superiority;
- 7 - significant superiority;
- 9 - very great superiority.

Each student fills in one table of pairwise comparisons of criteria (an example of filling is presented in table 3) and four - by the number of criteria - a table of pairwise comparisons of alternatives.[3]

	C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	C <sub>4</sub>	$\delta$	w
C <sub>1</sub>	1	1/5	1/5	1/5	0.30	0.056
C <sub>2</sub>	5	1	3	3	2.59	0.484
C <sub>3</sub>	5	1/3	1	1/5	0.76	0.142
C <sub>4</sub>	5	1/3	5	1	1.70	0.318
C <sub>5</sub>	5	1/3	5	1	1.20	0.209

Table 3. Pairwise assessment of criteria by one of the experts

Integral indicators for examples from tables 3- according to Formula 6 are: E1 and 0.215, E2 0.184, E3 0.039, E4 0.05, E5 0.155, E6 0.057. The maximum of these is E1 and 0.215 corresponds to the first alternative - FI1. In the example of one of the groups studying on a reduced full-time form of study, summarize the calculations.

As alternatives, 16 names are offered (Candidate 1... Candidate 15). The data are summarized in table 4 and drawings 2, Table 4 provides summary data from table 1 filled out by each of the experts. Thus, the results of the assessment of the importance of the selected criteria for the candidate of the mayor in the range of 0 to 1 are given.

Alternatives	Personality	Academic performance	Sociability	Incentiveness	Organizational work
Candidates 1	0.089	0,098	0,386	0,223	0,293
Candidates 2	0.287	0.120	0.602	0.208	0.069
Candidates 3	0.394	0.053	0.382	0.182	0.382
Candidates 4	0.319	0.085	0.288	0.249	0.379
Candidates 5	0.354	0.070	0.354	0.222	0.354
Candidates 6	0.379	0.067	0.391	0.151	0.391
Candidates 7	0.069	0.298	0.287	0.214	0.201

Candidates 8	0.182	0.110	0.380	0.370	0.150
Candidates 9	0.602	0.042	0.420	0.136	0.428
Candidates 10	0.053	0.089	0.394	0.319	0.319
Candidates 11	0,098	0.290	0.273	0.138	0.443
Candidates 12	0.120	0.089	0.130	0.319	0.319
Candidates 13	0.319	0.560	0.273	0.120	0.060
Candidates 14	0.120	0.053	0.260	0.182	0.382
Candidates 15	0.182	0.134	0.382	0.223	0.223
Average	0.237	0.150	0.360	0.210	0.281

Table 4. Summary table of criteria weight values.

From figure 1 it is clear that students of this group allocate communication in the first place, it is very important for them to establish contacts, to be able to constructive and friendly communication with other people. And only the last place is set by academic performance, this criterion is not a priority for this group. figure 2 shows the setting of the weights of the criteria for each expert. It should be noted that academic performance was the most important criterion for choosing a warden for only one person (Candidate 14). figure 2 shows the integral metrics of each student in the group, summarized by all the experts. The original head of the group was a man under the surname Candidate 14. The application of the method showed that it is only in the eighth place in terms of indicators, and the best head master will be the student Candidate 4, in connection with which the group has taken the initiative to change the head. The total weights of each criterion are calculated based on the results of the survey of all the groups that took part in the experiment. The results, shown in figure 2, show that the main criterion for choosing a warden student consider sociability (total weight 11.77), then academic performance (8.53) and organizational work (8.16) and only the last to take into account initiative (5,9).[3]

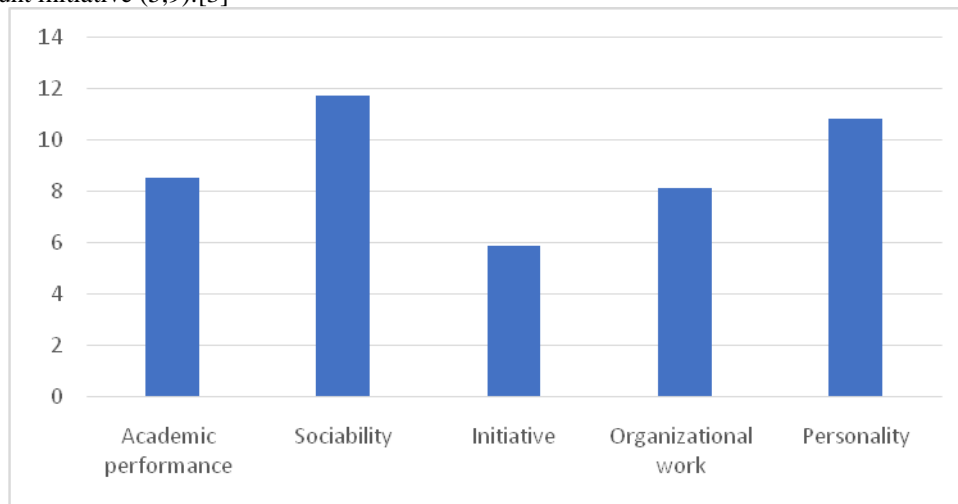


Fig. 2. The total weight of the criteria for all groups surveyed

The programmatic implementation of the described method, has been implemented. The number of criteria and alternatives introduced is the number of criteria and alternatives. The expert is required to fill out the tables with quantitative assessments; own vectors, weights, integral indicators and the best alternative are calculated automatically. It also features the automatic filling of tables with reverses.

#### IV. CONCLUSION

The analytical hierarchy method was used in several groups students and showed the following:

1. In one of the groups, the mayor appointed by the dean did not meet the optimal alternative for the group, and it was replaced with the chosen alternative.
2. In five groups, the correctness of choosing the warden was confirmed.



ISSN: 2350-0328

# International Journal of Advanced Research in Science, Engineering and Technology

Vol. 7, Issue 1 , January 2020

3. The priority criterion for the students surveyed is sociability, academic performance and organizational work are less important, but initiative is in the last place.
4. The practical application of the AHP method to the task of choosing a warden shows the possibilities of applying other methods of decision-making theory to the weakly structured multi-criteria tasks of the social and educational sphere.

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