

Paskibraka Member Selection Using A Combination Of AHP and TOPSIS Methods On The Office Of Youth And Sports Of Kutai Kartanegara Regency

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Abstract. Paskibraka as troops whose job is to flap the heritage duplicates flag. To become a Paskibraka a selection that participants are high school students are made. Because the number of participants of the selection of many support systems to facilitate the assessment process is made. This system uses Analytical Hierarchy Process (AHP) to determine the weight value criteria that comprise the value of the interview, health, physical, height and value rules for marching as well as using Technique For Others Preference by Similarity to Ideal Solution (TOPSIS) methods to seek best alternative participants. The calculation results of 21 alternative names best male and female of the participants and their school origin. The system has also been tested by performing the calculations manually using Microsoft Excel (Ms.Excel) to calculate the calculation of the system using AHP and TOPSIS.

1 Introduction

In Paskibraka elections a several main criteria on which to base an assessment is conducted. The assessment is then processed manually in order to get some of the names of the members elected Paskibraka. With so many alternative candidate members, it will take a long time in the selection process. To find the optimal alternative of a number of alternatives and certain criteria can use a decision support system with several methods namely Analytical Hierarchy Process (AHP) and Technique For Order Preference By Similarity To Ideal Solution (TOPSIS).

AHP is a method that uses human perception as the primary input for use as a base to look for eigenvalues, then determine Consistency Ratio. TOPSIS method to determine the best alternative solution [1].

Based on the description that has been presented, then built a system to help determine the election decision Paskibraka in Kutai Kartanegara regency using a combination of AHP and TOPSIS to find the best alternative solution.

2 Literature review

2.1 Decision Support System

Decision support system is a computer-assisted interactive system that supports the user in the ease of access to data and decision models in an effort to help

the decision-making process effective in solving problems that are semi-structured and unstructured [2].

Decision support system (DSS) is an interactive information system that provides information, modeling, and data manipulation. This system is used to assist decision making in semi-structured and unstructured situations [3].

From the above understanding, it can be concluded that Decision Support System (DSS) is a computer-based information system that approaches to generate various alternative decisions to assist certain parties in dealing with problems using data and models. A DSS only provides an alternative decision and then submitted to the user to make a decision.

Decision-making is the result of a selection process from a variety of alternative actions that may be chosen by a particular mechanism, with the aim of producing the best decision. Where the decision process is gradual, systematic, consistent and in every step from the beginning has included all parties, will give good results.

2.2 Paskibraka

Pasukan Pengibar Bendera Pusaka, or more commonly known as PASKIBRAKA, is an army in charge of raising the duplicate of the heirloom flag in the commemoration ceremony of the proclamation of Indonesian independence on 17 August held in three places, namely the Regency / Municipal level (Office of the Regent / Mayor) Provincial (Governor's Office), and National (State Palace) [4].

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2.3 Analytical Hierarchy Process (AHP)

Analytical Hierarchy Process (AHP) is one form of decision-making methods that use a functional hierarchy with the primary input is human perception. With hierarchy, something that is complex and unstructured broken into groups and then the group is set to be a form of hierarchy [5].

2.4 Technique for order preference by similarity to ideal solution (TOPSIS)

TOPSIS based on the concept that the best alternative was selected not only has the value of the shortest distance from the positive ideal solution, but it also has the longest distance value from the negative ideal solution. This concept is widely used in several models of Multi-Attribute Decision Making (MADM) to solve problems in a practical decision. This is due to the concept is simple and easy to understand, efficient computation, and has the ability to measure the relative performance of the alternatives in the form of a simple mathematical decision [6].

3 Research methodologies

3.1 Method of collecting data

- 1) *Literature*: The authors conducted a study of literature to find references related to the Decision Support System (DSS), Personal Home Page (PHP), My Structured Query Language (MySQL), books, text, journals and scientific works as a review of the literature to support research that does not deviate from the context.
- 2) *Field Observation*: Writers make a field trip to collect the necessary data is based on information FH Dian Suryadi, SE Paskibraka 2016 Selection Coordinator Kutai regency for participants judging criteria.
- 3) *Interview*: The authors conducted interviews to Mr. FH Dian Suryadi, SE to get the value criteria and the father Akhmad Dwi Ari Saputra, Amd.Kep to get the value of health.

3.2 Stage analysis

In the next stage of data analysis required data in the form of health values, interviews, physical ability, high body, and the value of the United Nations. The value is obtained from the recapitulation during selection done. The values will then be calculated using the AHP and TOPSIS methods.

3.3 Modeling of AHP-TOPSIS method

The initial phase of this system is a pad by clicking the input value comparison of each criterion by using the standard value comparison of AHP, then input the results

are processed using AHP to obtain eigenvalues. Eigen value is then used to find the value of consistency ratio, if in accordance with the standard value of consistency ratio continued to the calculation process by using TOPSIS method, otherwise it will repeat again to input the value of each criteria comparison. At the stage of using TOPSIS method will find the best solution of each alternative. Alternate data of selection participants entered and then stored. These alternatives have data in the form of health values, interviews, physical ability, high body and value rules for marching which is then used to find the value of each alternative weight. The best preference value would be PASKIBRAKA member recommendation of 21 sons and 21 daughters.

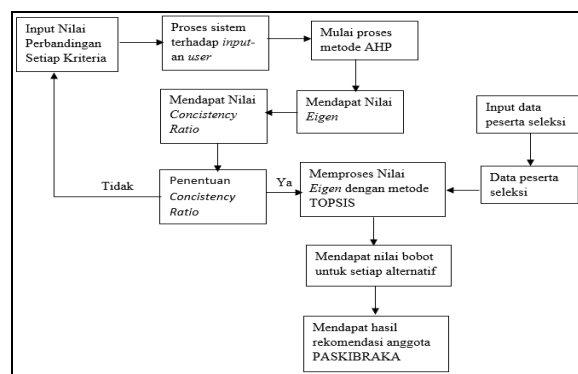


Fig. 1. System flow

4 Results and discussion

4.1 System analysis

AHP method is used as the first process base whose input value comes from admin and get the result of weight value criteria will be processed in the next calculation using TOPSIS method. The first stage in the system process is to include the comparative value of each criterion based on the standard AHP comparison value.

The second stage, the system will arrange the value of the comparison that has been inputted into a matrix of equation comparison. The third stage, after being a comparison matrix of equations, then the matrix is normalized. The fourth stage, the matrix normalization in total per line criteria provided then divided by 5 according to the number of criteria available produce eigen value / weight value.

The fifth stage, eigen values / weight value is then used to find the value consistency index, if the value CR of the calculation process AHP qualify CR (Consistency Ratio) received $CR \leq 0.1$ then the calculation process can be continued to methods TOPSIS, if No admin is required to enter again the criterion comparison value. The next stage is using TOPSIS method to search for the best alternative. The seventh stage, the system will store the critical weight value of the AHP method and then the admin will input the weight value of each

alternative. The value of alternative weight is then made into matrix and normalized.

The eighth stage, after normalization of the alternative assessment continued with weighted normalization using the weighted value criteria that have been obtained in the AHP calculation process. The ninth stage computes the ideal positive and ideal solution that produces the positive and negative ideal spacing of each alternative at the tenth stage. The final stage calculates the preference value for each alternative followed by sorting the preference value.

The recommendations are the best preferences of 21 alternative male and 21 female alternatives.

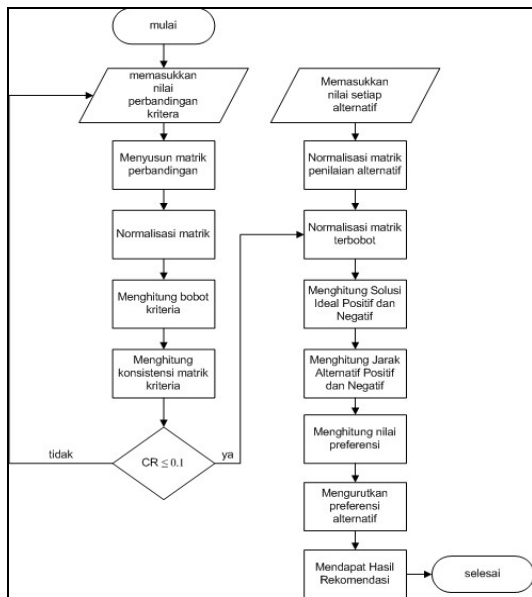


Fig. 2 calculation process flow system

4.2 System Implementation

Implementation system is a stage that is done after the system has been built based on the designs that have been made.

4.3 Home Page

Home Page contains an explanation of the method of AHP and TOPSIS on Selection Paskibraka and how to use this system. Homepage menu display can be seen in Figure 4.

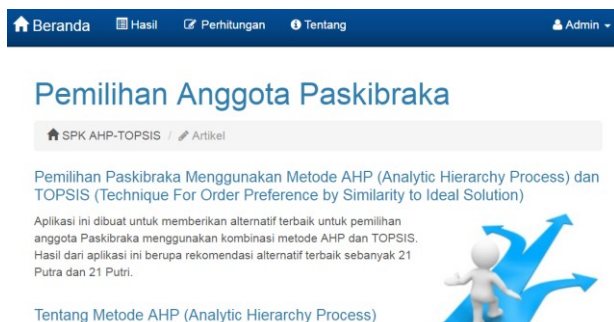


Fig. 3. Home Page

4.4 calculations page

On the Calculation page displays detailed calculations of AHP and TOPSIS methods starting from calculating the criteria weighted value to an alternative preference value. The Calculation page shows the entire system calculation from matrix comparison to alternative sorting based on value of preference / value of weighted criteria obtained. Calculation menu view can be seen in figure 4.



Fig. 4. Calculation Page

4.5 Result Page

Display Results menu displays the results of system recommendations based on the value of weight that has been entered by the admin. The recommendations in the form of 21 male and female names along with the school of origin and final score calculations. result page display can be seen in Figure 5.

Laki-laki				Perempuan			
No.	Nama	Asal Sekolah	Skor	No.	Nama	Asal Sekolah	Skor
1	RAHMAN HADI	SMK YPK TENGGARONG	0.908150	1	SEPTIANI WAHYU ANGGIRANI	SMAN 1 TENGGARONG	0.783491
2	MUHAMMAD ROJALI	SMAN 1 MUJARA MUNTAN	0.904717	2	JUMARNI	SMAN 1 MUJARA JAWA	0.780597
3	YUSHA WAHYU ADRI SETAWAN	SMAN 1 LIDA KULU	0.884365	3	LAILA CITRA SANDI	SMAN 2 TENGGARONG	0.774345
4	MUHAMMAD LUFANTO	SMAN 1 TENGGARONG	0.882782	4	NILUH MADE CHRISTY A.	SMAN 1 TENGGARONG	0.764687
5	ABDOEL MANAB	SMAN 1 MARANG KAJU	0.878876	5	JIHAN LAILY SALSABILA	SMAN 1 MUJARA MUNTAN	0.763206
6	M. HIDWATULLAH	SMAN 1 TENGGARONG	0.863613	6	CICILIA LIANI	SMAN 2 TENGGARONG	0.751910
7	WASINGUN ANWAR	SMAN 2 SEBULU	0.861074	7	HEZKA WINGKABATRI	SMAN 1 MUJARA JAWA	0.750890
8	RIZKI BAGUS FATURABSIAN	SMAN 2 TENGGARONG	0.844708				

Fig. 5. Page Results

4.6 System testing

System testing is done to determine the extent to which the success of the calculation of decision support systems that have been built. At this stage, the system will be tested by comparing the calculation of AHP and TOPSIS system with AHP and TOPSIS calculations performed manually.

Table 2. Sample Selection Participants Paskibraka

NO	NAME	PARTICIPANTS'S NUMBER	WHICH SCHOOL ARE YOU FROM	SELECTION RESULT			Height	UN
				Health	Interview	Physical test		
1	MUHAMMAD ROJALI	002	SMAN 1 Ma.MUNTAI	S	A	76	171	70
2	YUDHA WAHYU ADRI SETIAWAN	278	SMAN 1 LOA KULU	S	B	71	173	70
3	THE RAHMAN HADI	251	SMK YPK TGR	S	A	70	172	90
4	ABDOEL MANAB	254	SMAN 1 Ma.WOOD	S	B	68	170	89
5	MUHAMMAD LUFianto	052	SMKN 1 TGR	S	B	70	168	80

Table 3. Selection Criteria Paskibraka

Criteria	Criteria code
Health	K1
Interview	K2
Physical test	K3
Height	K4
marching	K5

1. Calculation of AHP method

Table 4. Table Pair Wise Comparisons

Criteria	k1	k2	k3	k4	k5
k1	1	4	1	0.25	2
k2	0.25	1	0.2	0.143	0.143
k3	1	5	1	1	3
k4	4	7	1	1	3
k5	0.5	7	0.333	0.333	1
amount	6.75	24	3.533	2.726	9.143

Table 5 Table Normalized Matrix Pair Wise Comparisons

criteria	k1	k2	k3	k4	k5	Jumlah	Average / priority weight
k1	0.148	0.166	0.283	0.091	0.218	0.908	0.182
k2	0.037	0.041	0.056	0.052	0.015	0.203	0.041
k3	0.148	0.208	0.283	0.367	0.328	1.335	0.267
k4	0.592	0.291	0.283	0.367	0.328	1.862	0.372
k5	0.074	0.291	0.093	0.121	0.109	0.689	0.138

Table 6. Vector Weight Value

Vector of weight
0.981
0.212
1.439
2.066
0.727

Calculating CR value

$$\lambda_{max} = \frac{((0.981/0.182) + (0.212/0.041) + (1.439/0.267) + (2.066/0.372) + (0.727/0.138))}{5} = 5.361$$

$$CI = \frac{5.361 - 5}{5 - 1} = 0.090$$

$$CR (Consistency Ratio) = \frac{0.090}{1.12} = 0.080$$

By CR (Consistency Ratio) generated is less than 0.1 or $CR \leq 0.1$, the final result can be justified and can proceed to the next step and conclude that the comparison between the criteria consistently.

2. Calculation of TOPSIS method

Table 7 Alternative Assessments

Alternative/ No participants	Alternative Rating Matrix				
	K1	K2	K3	K4	K5
002	5	5	76	171	70
052	5	3	70	168	80
251	5	5	70	172	90
278	5	3	71	173	70
254	5	3	68	170	89

Table 8 Normalized Matrices Weighted

Alternative/ No participants	Normalized Matrix Weighted				
	K1	K2	K3	K4	K5
002	0.081	0.023	0.127	0.166	0.053
052	0.081	0.013	0.117	0.163	0.061
251	0.081	0.023	0.117	0.167	0.069
278	0.081	0.013	0.119	0.168	0.053
254	0.081	0.013	0.114	0.165	0.068

Table 9 Positive Ideal Matrix Solutions & Ideal Negative Matrix Solutions

	K1	K2	K3	K4	K5
K^+	0.081	0.023	0.127	0.168	0.069
K^-	0.081	0.013	0.114	0.163	0.053

Table 10 Positive Distance Matter and Alternative Negative Distance

Alternative	Distance +	Distance -
2	0.0155	0.0166
52	0.016	0.008
251	0.010	0.0187
278	0.0198	0.007
254	0.0166	0.0147

$$V_2 = \frac{0.01663}{0.01663 + 0.0155} = 0.517$$

$$V_{52} = \frac{0.008}{0.008+0.016} = 0.337$$

$$V_{251} = \frac{0.0187}{0.0187+0.010} = 0.648$$

$$V_{278} = \frac{0.007}{0.007+0.0198} = 0.260$$

$$V_{254} = \frac{0.0147}{0.0147+0.0166} = 0.469$$

Table 11 Preference Value

Alternative	Preference	Alternate Sequence	Preference Sequence
2	0.517	251	0.648
52	0.337	2	0.517
251	0.648	254	0.469
278	0.2608	52	0.337
254	0.469	278	0.260

The order of selection of members Paskibraka recommendations were counted manually in the order recommendation Paskibraka members is calculated using the system seen in Figure 10 with the difference of each alternative 0001.

No.	Nama	Asal Sekolah	Skor
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4	MUHAMMAD LUFianto	SMKN 1 TENGGARONG	0.882782
5	ABDOEL MANAB	SMAN 1 MARANG KAYU	0.878876

Fig. 6. System Calculation Results

4.7 Validation of results

After testing the calculation of the system run in accordance with the manual calculation then input all participants as much as 73 men and 69 women. All

participants of the election Paskibraka alternative stored next step is to do a comparison of the value of the 5 existing criteria namely health, interview, physical test, height, and the value of the UN. Then the results of recommendations based on the system validated against the results of selection conducted directly by the Dispora Kutai Kartanegara.

The validation result between the recommendation of the system and the direct selection by the committee is 40.47% value less than 50% so it is assumed the result of less precise but precise calculation method. The result of validation is very less because there are several factors that can not be calculated by the system such as preferably the members paskibraka school and the appearance of the selection participants.

5 Conclusion

Analytical Hierarchy Process (AHP) and Technique For Order Preference By Similarity To Ideal Solution (TOPSIS) successfully applied in decision support system of Paskibraka selection in Youth and Sports Department of Kutai Kartanegara Regency. The criteria chosen in this research are health, interview, physical test, high body, and PBB can be processed and then produce recommendation through stages that have been specified in method AHP and TOPSIS

References

1. S. Maharani, HR. Hatta, G. Merdiko, " *Articles of Bali International Seminar On Science and Technology.* (2014)
2. D. U. Daihani, *Computerized Decision Making.* Bogor: Ghalia Indonesia. (2001)
3. Kusrini. *Concept and Application of Decision Support System.* Yogyakarta: Andi Offset. 2007.
4. *Regulation of the Minister of Youth and Sports of the Republic of Indonesia* Number 0065 of 2015.
5. Padmowati, RdLE, *Measurement Index Consistency In Decision Making Process Using AHP Method.* Semnas IF. 2009.
6. Kusumadewi, Sri, et al. *Fuzzy Multi Attribute Decision Making.* Yogyakarta: Graha Science. 2006.
7. A. Rasyid, S. Maharani, *Journal of Informatics Mulawarman* Vol. **11**, No. 2, September 2016. "
8. W Idodo, PP, and Herlawati. *Using UML (Unified Modeling Language.* Bandung: Informatics, 2011.
9. JL. Whiten, and LD. Bentley, *System Analysis and Design Methods* Seventh Edition. New York: The McGraw-Hills Company. 2007.