

Development of Decision Support System for Selection Paskibraka Members of South Sumatera Province Using TOPSIS Method

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ABSTRACT

Paskibraka is an organization of flag hoisting troops in Indonesia. This group will lead the flag-raising on Indonesia big day, such as Independence Day. This organization opens selection every year for high school students only with several requirements needed. For becoming this member, they also have to pass various selection with their criteria. In obtaining a more accurate assessment of Paskibraka members, a decision support system will be providing recommendations on the results of the system to decision-makers in determining the final results. By this recommendation system, can support the decision for choosing delegates from the south Sumatera to the national level. In implementing a decision support system, it can apply the Technique For Others Reference by Similarity to Ideal Solution (TOPSIS) method that appropriate for multi-criteria decision-making cases.

Keywords: decision support system, TOPSIS method, flag hoisting troops, Paskibraka

INTRODUCTION

Processes leading to opposite poles in cultural, political, and economic, even the relationship between them has been far more complex, it builds up the nationalism and globalization.[2] Flag Hoisting Troops (PASKIBRAKA) are the best youth of the nation, candidate of nation leaders who are recruited and selected in every level of stages, through systems and mechanisms of education and training that increase and triggered national values and strengthen mental and physical aspects in order to have prime ability in carry out his duties as an flag hoisting troops. [4] The government held a selection at every level, starting from the district/city level, provincial level, and national level. At the provincial level, especially in the province of South Sumatera, selected students are students who have first been passed from each district/city selection that consists of male and female students. In 2018 enrolled students were 68 students and in 2019 increased became 102 students due to the high demand, while the number chosen to become a member of the South Sumatera Paskibaraka is 50 students (25 male and 25 female) for South Sumatera Province and 2 best students (1 male and 1 female) will be delegated to National level from South Sumatera. it consists of 4 types of tests, such as health, psychological testing, physical fitness, and body posture. Paskibraka in South Sumatera is held and responsible by Dinas Pemuda dan Olahraga Sumatera Selatan.

A decision support system is subsystems intended to help decision-makers with interactive computer-based systems and use communications technologies, data, documents, knowledge and/or models to identify and solve problems and make decisions [1].

LITERATURE REVIEW

In research about decision support systems for supplier selection in the automotive industry using AHP, the AHP method is making the problem is divided into two hierarchies (main criteria and sub-criteria). 3 alternatives tested to this case because in AHP can't proceed in many alternatives because AHP will make the structure and compare every criteria and alternative that exist. And also each criterion having importance scale in pair-wise comparison to choosing the criteria of supplier selection. [4] In research about the decision support system for selecting the best employees using TOPSIS, TOPSIS is used because the recommendation system has results based on comparison from the shortest ideal solution and farthest ideal solution.[3]

Decision Support System

Decision Support System (DSS) is proposed for semi-structured buying decisions. The DSS has been designed considering, on one hand, the main features of a semi-structured decision problem. The decision process is not a linear one; the DSS is designed to allow the DM to come back to earlier phases in the course of the learning process.[7]

According to Simon, the process of making a decision is divided into 4 phases, such as [8]:

Intelligence phase.

This stage is the identification process carried out by decision-makers for all problems that must be resolved. At this stage, the decision-maker is required to understand the problem.

Design phase.

This stage is the process of modeling the problem that has been previously defined by outlining the decision elements, alternative decision variables, and evaluation criteria were chosen.

Selection phase.

This stage is the stage of choosing a solution produced by a model. If the solution can be accepted at this phase, then proceed with the implementation phase of the decision solution.

Implementation phase

At this stage is a solution that has been proposed in the problem is an initiation or introduction to changes which are then managed.

TOPSIS

TOPSIS is a method found by Yoon and Hwang for solving multi-criteria decision making cases. [9]

Make a decision matrix.

This matrix will be evaluated based on the criteria of alternatives.

Make a decision matrix is normalized.

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^m x_{ij}^2}}$$

Make a decision matrix is normalized weighted.

$$y_{ij} = w_i r_{ij}$$

Prescribing the positive and negative ideal solution with the ideal solution matrix.

Positive ideal solution :

$$y_j^+ = \begin{cases} \max_i y_{ij}; & \text{if } j \text{ is benefit attribute} \\ \min_i y_{ij}; & \text{if } j \text{ is cost attribute} \end{cases}$$

Negative Ideal solution :

$$y_j^- = \{(\min Y_i)\}$$

$$y_j^- = \begin{cases} \min_i y_{ij}; & \text{if } j \text{ is benefit attribute} \\ \max_i y_{ij}; & \text{if } j \text{ is cost attribute} \end{cases}$$

5. Calculating separation

Positive Ideal Solution :

$$D_i^+ = \sqrt{\sum_{j=1}^n (y_{ij} - y_j^+)^2}$$

Negative Ideal Solution :

$$D_i^- = \sqrt{\sum_{j=1}^n (y_{ij} - y_j^-)^2}$$

6. Calculating the relative proximity to the positive ideal solution.

$$D_i = \frac{D_i^-}{D_i^+ + D_i^-}$$

7. Alternative rank.

RESEARCH METHODS

According to Simon, the process of making a decision is divided into 4 phases, such as [8]:

Intelligence phase.

This stage is the identification process carried out by decision-makers for all problems that must be resolved. There are primary data and secondary data. Primary data is collected by interview with Dinas Pemuda dan Olahraga Sumsel as an institute that held the program. And Secondary data is collected by literature review with previous research. And then, in this stage should be analyzing the problem or opportunity that likely happens under the old decision-making system, such as inaccuracy entry data, longer time to process and how to manage the data.

Design phase.

This stage is the process of modeling the problem that has been previously defined by outlining the decision elements, alternative decision variables, and evaluation criteria were chosen. The model will be validated by the criteria set out to conduct an alternative evaluation of the selected decision. The process of determining a solution is a process for designing or developing alternatives, determining decisions and assigning values and weights given to each alternative that exists.

Selection phase.

This stage is the stage of choosing a solution produced by a model.

Implementation phase

This stage is the implementation of a system that already designs in the design phase.

RESULTS AND DISCUSSION

This research is needed to determine :

Criteria

Table 1. Criteria

Criteria	Weight (%)	Type
Writing Test (C1)	10	Benefit
Interview (C2)	20	Benefit
Health (C3)	20	Benefit
Physical Fitness (C4)	25	Benefit
Body Posture (C5)	25	Benefit

Subcriteria

Table 2. Subcriteria of Writing Test

Range of Writing Test	Value
76-100	100
51-75	80
26-50	60
0-25	40

Table 3. Subcriteria of Interview

Description	Value
Good Attitude, communicate well and have other skill	100
Good attitude and communicate well	80
Less polite and not good enough in communicating	60
Not polite and can't communicate well	40

Table 4. Subcriteria of Health

Health	Description	Value
A ⁺	All Health Aspects Well	100
A	9 Health Aspects Well	90
A ⁻	8 Health Aspects Well	80
B ⁺	7 Health Aspects Well	70
B	6 Health Aspects Well	60
B ⁻	5 Health Aspects Well	50
C ⁺	4 Health Aspects Well	40
C	3 Health Aspects Well	30
C ⁻	2 Health Aspects Well	20
D	1 Health Aspects Well	10

Subcriteria of health based on medical checkup in 10 aspects (liver, heart, lungs, kidney, eyes, ears, nose, throat and body).

Table 5. Subcriteria of Physical Fitness

Description	Value
Physical Fitness above standard	100
Physical Fitness fulfill the standard	80
Physical Fitness only enough in standard	60
Physical Fitness below standard	40

Assessment of physical fitness is count by amount of Sit Up, Push Up and Shuttle Run with a predetermined standard.

Table 6. Subcriteria of Posture

Description	Value
Very Good Posture	100
Good Posture	80
Good Enough Posture	60
Bad Posture	40

Table 7. Alternative Data

Gender	Name	C1	C2	C3	C4	C5
Male	L1	80	80	80	60	60
Male	L2	40	100	90	80	80
Male	L3	100	80	80	60	100
Male	L4	80	60	90	80	80
Male	L5	80	80	70	40	60

Steps in TOPSIS :

1. Make a decision matrix.

$$L = \begin{bmatrix} 80 & 80 & 80 & 60 & 60 \\ 40 & 100 & 90 & 80 & 80 \\ 100 & 80 & 80 & 60 & 100 \\ 80 & 60 & 90 & 80 & 80 \\ 80 & 80 & 70 & 40 & 60 \end{bmatrix} \quad P = \begin{bmatrix} 80 & 60 & 80 & 80 & 100 \\ 100 & 40 & 90 & 60 & 40 \\ 60 & 80 & 70 & 80 & 60 \\ 80 & 60 & 100 & 40 & 80 \\ 40 & 100 & 60 & 60 & 60 \end{bmatrix}$$

2. Make a decision matrix is normalized.

Table 8. Normalized Matrix

R	C ₁	C ₂	C ₃	C ₄	C ₅
R1	0.455842306	0.441726104	0.434500357	0.40824829	0.346410162
R2	0.227921153	0.55215763	0.488812902	0.544331054	0.461880215
R3	0.569802882	0.441726104	0.434500357	0.40824829	0.577350269
R4	0.455842306	0.331294578	0.488812902	0.544331054	0.461880215
R5	0.455842306	0.441726104	0.380187813	0.272165527	0.346410162

3. Make a decision matrix is normalized weighted.

Table 9. Weighted Normalized Matrix

R	Y_1	Y_2	Y_3	Y_4	Y_5
W	0.1	0.2	0.2	0.25	0.25
R_1	0.045584231	0.088345221	0.086900071	0.102062073	0.08660254
R_2	0.022792115	0.110431526	0.09776258	0.136082763	0.115470054
R_3	0.056980288	0.088345221	0.086900071	0.102062073	0.144337567
R_4	0.045584231	0.066258916	0.09776258	0.136082763	0.115470054
R_5	0.045584231	0.088345221	0.076037563	0.068041382	0.08660254

4. Prescribing the positive and negative ideal solution with the ideal solution matrix.

Table 10. Positive ideal solution

	0.056980288
	0.110431526
	0.09776258
	0.136082763
Y_5^+	0.144337567

Table 11. Negative Ideal Solution

1^-	0.022792115
2^-	0.066258916
3^-	0.076037563
4^-	0.068041382
5^-	0.08660254

5. Calculating separation

Table 12. Positive ideal

D+	
D1+	0.072293913
D2+	0.044745553
D3+	0.041990551
D4+	0.053985396
D5+	0.095145228

Table 13. Negative Ideal

D-	
D1-	0.047777473
D2-	0.088804048
D3-	0.077000289
D4-	0.080339404
D5-	0.03173776

6. Relative proximity. for example:

$$V^1 = \frac{0.047777473}{(0.047777473 + 0.072293913)} = 0.397908898$$

7. Alternative Rank

No.	Na me	Value
1.	L2	0.664951803
2.	L3	0.647111062
3.	L4	0.598098074
4.	L1	0.397908898
5.	L5	0.250134083

CONCLUSION

The implementation of the TOPSIS method can give a recommendation system to help the decision-maker to take the final decision. The result is taken by sorting the alternatives that have comparison results between the farthest ideal solution and the shortest ideal solution from negative and positive solutions. The result is used to support a decision for being Paskibraka members in South Sumatera Province and delegates for goes to National.

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