DECISION SUPPORT SYSTEM FOR ADMISSION OF PROSPECTIVE STUDENT ASSOCIATION MEMBERS WITH THE PROMETHEE METHOD

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Abstract: This study examines how promethee can be a suitable method to be used in the decision-making system of prospective student association members as an organization under the auspices of the university. In this study, it is explained that the decision-making system for the acceptance of prospective student associations as an organization within the university environment experiences several problems in the process, namely, most of the associations still use the manual method. This of course not only has an impact on the effectiveness of the time and energy used but also affects the decisions taken. Promethee is one of the methods in the decision-making system that can be used by students considering that promethee is more efficient in time, effort, and objectivity in making better decisions. Researchers in this study also analyze and describe the scheme or flow of the promethee method that can be used by students as well as basic criteria such as academic, activeness, nature, and confidence possessed. This basic criterion can be one of the reference guidelines used in the selection and decision-making stages.

Keywords: decision making system; promethee; student association

Abstrak: Penelitian ini mengkaji tentang bagaimana promethee bisa menjadi salah satu metode yang cocok untuk digunakan dalam sistem pengambilan keputusan calon anggota himpunan mahasiswa sebagai organisasi yang berada di naungan universitas. Penelitian ini menjelaskan bahwasanya sistem pengambilan keputusan penerimaan calon himpunan mahasiswa sebagai organisasi yang berada di lingkungan universitas mengalami beberapa masalah dalam prosesnya yakni Sebagian besar himpunan masih menggunakan metode yang manual. Hal ini tentu tidak hanya berdampak pada efektivitas waktu dan tenaga yang digunakan melainkan juga mempengaruhi keputusan yang diambil. Promethee menjadi salah satu metode dalam sistem pengambilan keputusan yang bisa digunakan oleh mahasiswa mengingat promethee lebih efisien dalam waktu, tenaga hingga tingkat objektivitas dalam pengambilan keputusan yang lebih baik. Peneliti dalam kajian ini juga menganalisis dan menjabarkan tentang skema atau alur yang metode promethee yang bisa digunakan oleh mahasiswa serta kriteria dasar seperti akademik, keaktifan, sikap dan kepercayaan diri yang dimiliki. Kriteria dasar ini bisa menjadi salah satu referensi pedoman yang digunakan dalam tahap penyeleksian dan pengambilan keputusan.

Kata kunci: himpunan mahasiswa; promethee; sistem pengambilan keputusan,

INTRODUCTION

The Student Association is one of the growing student organizations in tertiary institutions. An association must have a vision and mission to be realized. In an effort to realize this, we need members who have good quality, have responsibility, are creative, have the discipline to work hard and can work well together. The goal is that student associations can not only carry out their vision and mission properly but also make improvements and changes in the future [1].

Chairman of the Association is required to be able to make decisions quickly and accurately, to determine members. So far, the decision-making mechanism for accepting Association members is still done manually. Therefore it is necessary to build a decision support system to determine Association members who will help determine who is eligible to become a member [2].

To obtain students who are in accordance with the vision and mission of the association, the student selection process must be able to determine the appropriate criteria and must be prepared as much as possible [3]. Because most of the selection process is still done manually, it is considered less than optimal and requires quite a lot of time and the possibility of subjective judgment. To overcome the above problems, it is necessary to create a decision support system application to assist the association in selecting students according to the criteria [4].

One of the assessment systems that can be used is the Enrichment Evaluation Preference Method (Promethee). Assessment of prospective members of student associations using the Promethee method will provide established decision support related to the assessment and selection of a series of options based on

several criteria with the aim of ranking among the factors [5]. Promethee can simultaneously handle both qualitative and quantitative criteria. This method can process uncertain and unclear information. Organizational method rating preference for Promethee enrichment evaluation method analysis decisions. This method will ultimately produce the best alternative out of several options with the lowest cost and rating [6]. The Promethee method was once applied in a study for Selection of Candidate Members of the HIMATIKA Association Using the Promethee Method [7] and used also for the selection of the best lecturers [8].

Decision Support System (DSS) is a system that has advantages in solving problems and communication related to situations that are semi and unstructured. This system is an effort to develop an existing management system into a system that is integrated with technology, namely a computerized system with a specific design that makes it easier for users to use it. This system has a characteristic that is interactive. This means that this system provides facilities for integrating various components in the decision-making process such as techniques, analysis, procedures, experience to managerial knowledge in building a flexible decision framework [9].

The complexity of the decision-making process depends on the number of criteria and alternatives considered in the evaluation. However, there are several techniques that support decision makers in choosing the optimal solution. The Multi Criteria Decision Aid (MCDA) method provides a variety of techniques for solving complex problems and, therefore, has been used significantly in various fields. Analytical Hierarchy Process (AHP), Techniques for Order preference

by Simi-larity to Ideal Solution (TOP-SIS), Multi Attribute Utility Theory (MAUT) and Preference Ranking Organization Method for Enrichment Evaluation (PROMETHEE) are popular MCDA methods that rank the most reliable alternatives. depending on the decision maker's preference. Obviously there is no good or bad MCDA method, each has its advantages, and the choice depends solely on the nature of the problem to be solved [10].

This study aims to find out how the decision support system for admitting prospective members of student associations using the Promethee method can help reduce subjective selection in student associations.

METHOD

The observation method is the method used in this study. Observations were made on the Pradita University association, and obtained 4 criteria that are usually used in the selection process for prospective members and the value of each criterion is determined using numbers 1 to 5. Data from 5 students is taken and given their respective values so that the student data can be calculated and processed using the promethee method. Image 1 describes the flow of the Promethee method.
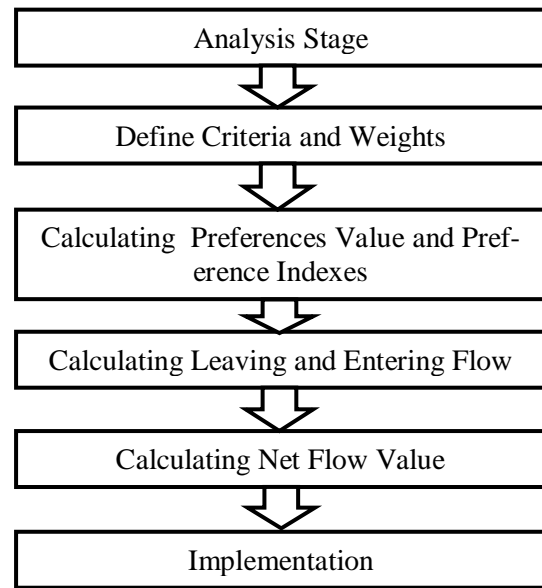
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┌─────────────────────────────┐
│      Analysis Stage         │
└─────────────────────────────┘
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│  Define Criteria and Weights│
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┌─────────────────────────────┐
│ Calculating Preferences     │
│ Value and Preference Indexes│
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┌─────────────────────────────┐
│ Calculating Leaving and     │
│ Entering Flow               │
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│ Calculating Net Flow Value  │
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│      Implementation         │
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Image 1. Promethee Method Flow [5]

a. Analysis Stage
   Gather what information is needed, define system requirements.
b. Define Criteria and Weights
   At this stage, the criteria and weights are determined in order to be able to make comparisons between variables.

c. Calculating Preference Values and Preference Indexes
   At this stage a comparison is made for each criterion, then the results and comparisons are divided by the number of criteria and multiplied by the weight of the criteria using formula (1)

$$H(d) = \begin{cases} 1. \text{ if} \geq 0 \\ 0. \text{ if} < 0 \end{cases} \qquad (1)$$

then the preference index value is calculated using formula (2)

$$\emptyset(a, b) = \sum_{i=1}^{n} \pi_i P_i(a, b) : \forall a, b \in A$$

(2)

d. Calculating the value of Leaving

Flow and Entering Flow
After getting all the preference index values, the Promethee method can obtain the leaving flow index according to formula (3)

$$\emptyset^+(a) = \frac{1}{n-1}\sum_{x\in A}\vartheta(a, x) \qquad (3)$$

and Entering Flow according to formula (4)

$$\emptyset^-(a) = \frac{1}{n-1}\sum_{x\in A}\vartheta(x, a) \qquad (4)$$

to determine relative preferences and other alternatives.

e. Calculating Net Flow Value
After obtaining the outflow and inflow values, the next step is to determine the Net Flow value using formula (5)

$$\emptyset = \emptyset^+(a) - \emptyset^-(a) \qquad (5)$$

after the net flow value is obtained, the ranking results are displayed.

f. Implementation
Build software components, document systems, install systems [11].

The Promethee method itself has been used to solve various problems. In manufacturing, it is used to aid decision-making and four real-life situations of manufacturing situations were tested, a large-scale composting technology sustainability assessment in which six composting systems, including open, closed and reactor technology, were evaluated in terms of environmental criteria. , financial/economic, social and technical, failure modes and effects analysis and Preference modeling experiments [12]. This method has also been used for comparisons and rankings in industrial companies. This procedure is based on the competence of the company [13].

RESULT AND DISCUSSION

In accordance with the flow of the promethee method, the first step in using this method is the problem analysis stage. In the analysis of this problem, an overview of the process of selecting good criteria is carried out in the process of selecting prospective members of student associations using the promethee method. At this stage, the data classification needed to develop selection criteria will be carried out [14]. The criteria selected to determine prospective members of student associations are in accordance with table 1 :

Table 1. Criteria and Value

No.	Criteria	Sub-Criteria	Value
1.	Academic (K1)	IP <3.5	5
		IP 3.0-3.49	4
		IP 2.0-2.99	3
		IP 1.0-1.99	2
		IP 0-0.99	1
2.	Activeness (K2)	Active	5
		Normal	3
		Passive	1
3.	Attitude (K3)	Very Good	5
		Good	4
		Normal	3
		Bad	2
		Very Bad	1
4.	Confidence (K4)	Very Good	5
		Good	4
		Normal	3
		Bad	2
		Very Bad	1

Table 2. Prospective Member Data

Code	Alternative	K1	K2	K3	K4
M1	Student A	4	3	3	5
M2	Student B	2	5	4	3
M3	Student C	5	1	2	4
M4	Student D	1	5	5	2
M5	Student E	3	3	1	5

After the data is obtained, the next step is to calculate the preference value of each existing criterion using formula (1).

1. Academic preference scores (FK1)
FK1(M1,M2)
d= FK1(M1)-FK1(M2)
d = 4 – 2
d = 2
d > 0, then H(d)= 1

2. Activeness preference scores (FK2)
FK2(M1,M2)
d = FK2(M1)-FK2(M2)
d = 3 – 53
d = -2
d < 0, then H(d)= 0

3. Attitude preference scores (FK3)
FK3(M1,M2)
d = FK3(M1)-FK3(M2)
d = 3 – 4
d = -1
d < 0, then H(d)= 0

4. Confidence preference scores (FK4)
FK4(M1,M2)
d = FK4(M1)-FK4(M2)
d = 5 – 3
d = 2
d > 0, then H(d)= 1

Table 3. Preference Table

(d)	FK1	FK2	FK3	FK4
(M1,M2)	1	0	1	1
(M2,M1)	0	1	1	0
(M1,M3)	0	1	1	1
(M3,M1)	1	0	0	0
(M1,M4)	1	0	0	1
(M4,M1)	0	1	1	0
(M1,M5)	1	0	1	0
(M5,M1)	0	1	0	0
(M2,M3)	0	1	1	0
(M3,M2)	1	0	0	1
(M2,M4)	1	0	0	1
(M4,M2)	0	1	1	0
(M2,M5)	0	0	1	0
(M5,M2)	1	1	0	1
(M3,M4)	1	0	0	1
(M4,M3)	0	1	1	0
(M3,M5)	1	0	1	0
(M5,M3)	0	1	0	1
(M4,M5)	0	1	0	0
(M5,M4)	1	0	1	1

After the data is entered into table 2, the next step is to calculate the Preference Index Value using formula (2)

Π(M1,M2) = 1/4 (1+0+1+1) = 0,75
Π(M2,M1) = 1/4 (0+1+1+0) = 0,5
Π(M1,M3) = 1/4 (0+1+1+1) = 0,75
Π(M3,M1) = 1/4 (1+0+0+0) = 0,25
Π(M1,M4) = 1/4 (1+0+0+1) = 0,5
Π(M4,M1) = 1/4 (0+1+1+0) = 0,5
Π(M1,M5) = 1/4 (1+0+1+0) = 0,5
Π(M5,M1) = 1/4 (0+1+0+0) = 0,25
Π(M2,M3) = 1/4 (0+1+1+0) = 0,5
Π(M3,M2) = 1/4 (1+0+0+1) = 0,5
Π(M2,M4) = 1/4 (1+0+0+1) = 0,5
Π(M4,M2) = 1/4 (0+1+1+0) = 0,5
Π(M2,M5) = 1/4 (0+0+1+0) = 0,25
Π(M5,M2) = 1/4 (1+1+0+1) = 0,75
Π(M3,M4) = 1/4 (1+0+0+1) = 0,5
Π(M4,M3) = 1/4 (0+1+1+0) = 0,5
Π(M3,M5) = 1/4 (1+0+1+0) = 0,5
Π(M5,M3) = 1/4 (0+1+0+1) = 0,5
Π(M4,M5) = 1/4 (0+1+1+0) = 0,5

$\Pi(M5,M4) = 1/4\ (1+0+0+1) = 0,5$

Table 4. Preference Index Table

(d)	M1	M2	M3	M4	M5
M1	-	0,75	0,75	0,5	0,5
M2	0,5	-	0,5	0,5	0,25
M3	0,25	0,5	-	0,5	0,5
M4	0,5	0,5	0,5	-	0,25
M5	0,25	0,75	0,5	0,5	-

After the preference index value is obtained, the Leaving Flow Value calculation is performed according to formula (3) and Entering Flow according to formula (4)

a. Calculation of Leaving Flow :
$\emptyset+M1 = 1/(5-1)\ (0,0 + 0,75 + 0,75 + 0,5 + 0,5)$
$\emptyset+M1 = 0,25\ (2,5) = 0,625$
$\emptyset+M2 = 0,25\ (1,75) = 0,4375$
$\emptyset+M3 = 0,25\ (1,75) = 0,4375$
$\emptyset+M4 = 0,25\ (1,75) = 0,4375$
$\emptyset+M5 = 0,25\ (1,75) = 0,4375$

b. Calculation of Entering Flow:
$\emptyset^-M1 = 1/(5-1)\ (0,0 + 0,5 + 0,25 + 0,5 + 0,25)$
$\emptyset^-M1 = 0,25\ (1,5) = 0,375$
$\emptyset^-M2 = 0,25\ (2,5) = 0,625$
$\emptyset^-M3 = 0,25\ (2,25) = 0,5625$
$\emptyset^-M4 = 0,25\ (2) = 0,5$
$\emptyset^-M5 = 0,25\ (1,5) = 0,375$

The final step is to calculate the Net Flow Value using formula (5)

$\emptyset M1 = 0,625 - 0,375 = 0,25$
$\emptyset M2 = 0,4375 - 0,625 = -0.1875$
$\emptyset M3 = 0,4375 - 0,5625 = -0,125$
$\emptyset M4 = 0,4375 - 0,5 = -0,0625$
$\emptyset M5 = 0,4375 - 0,375 = 0,0625$

Table 5. Net Flow Value

Code	Alternative	Net Flow
M1	Mahasiswa A	0,25
M2	Mahasiswa B	-0,1875
M3	Mahasiswa C	-0,125
M4	Mahasiswa D	-0,0625
M5	Mahasiswa E	0,0625

Based on the net flow value above, the ranking of each student can be obtained. The results of students with the highest ranking are explained in table 6:

Table 6. Final Results

Alternative	Net Flow	Ranking
Mahasiswa A	0,25	1
Mahasiswa E	0,0625	2
Mahasiswa D	-0,0625	3
Mahasiswa C	-0,125	4
Mahasiswa B	-0,1875	5

CONCLUSION

Based on the ranking of the final results of the promethee method, the highest net flow score was student A with a score of 0.25 and the lowest score was student B with a score of -0.1875. According to this ranking, the selection of prospective members can be carried out based on the existing rankings and with the value of the promethee method, the decision making in selecting prospective members of the association can have a definite value to reduce subjective selection.

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