Jurnal Teknik Informatika C.I.T Medicom, 15 (4) (2023) 169-176

Published by: Institute of Computer Science (IOCS)

Jurnal Teknik Informatika C.I.T Medicom

Journal homepage: www.medikom.iocspublisher.org

Decision support system for selection of the best faculty staff using the analytical hierarchy process (AHP) method

Titus Kristanto[1], Dahliar Ananda[2], Achmad Muzakki[3], Dewi Rahmawati[4], Riza Akhsani Setyo Prayoga[5]

[1,2,3,4,5] Department of Software Engineering, Institut Teknologi Telkom Surabaya

Article Info

Article history

Received : May 30, 2023
Revised : Jun 18, 2023
Accepted : Aug 3, 2023

Keywords:

Analytical Hierarchy Process;
Decision Support System;
Faculty Staff;
Selection.

Abstract

The Faculty of Information Technology and Business is one of the faculties at the Telkom Surabaya Institute of Technology. This faculty has four staff, namely Prasetya, Setyawan, Pertiwi, and Berliana. Every semester, faculty leaders (deans and deputy deans) evaluate faculty staff based on predetermined criteria to provide the best performance for the faculty in carrying out their duties and obligations. Assessment of faculty staff selection is based on criteria, namely service, discipline, commitment, and cooperation. The decision support system for selecting the best faculty staff uses the Analytical Hierarchy Process (AHP) method, where the decision-making process is based on an alternative assessment process based on predetermined criteria. Calculations using the AHP method are in the form of ranking the importance of each criterion and making recommendations for the best faculty staff, where the order of criteria starts with the criteria of service, cooperation, discipline, and commitment. Alternative matrix calculations yielded a score of 0.4963 for Prasetya, a score of 0.1893 for Setyawan, a score of 0.1873 for Pertiwi, and a score of 0.127 for Berliana, so that the best faculty staff recommendations were obtained by Prasetya with the highest score of 0.4963.

Corresponding Author:

Titus Kristanto,
Bisnis Digital,
Institut Teknologi Telkom Surabaya,
Jl. Ketintang No. 156 Surabaya, East Java, Indonesia,
Email: tintus.chris@gmail.com

1. Introduction

The Faculty of Information Technology and Business is one of the faculties at the Telkom Surabaya Institute of Technology. Every semester, faculty leaders (deans and deputy deans) conduct selection activities for the best faculty staff based on criteria determined by the faculty leadership. The criteria for selecting the best faculty staff are service, discipline, commitment, and cooperation. The selection criteria support the decision support system [1].

The problem faced in selecting the best faculty staff is that there is no decision support system model in determining the best faculty staff. Another problem faced is that it is difficult to determine the best faculty staff, because the assessment is based on the results of the majority of votes from all lecturers in the Faculty of Information Technology and Business, so that faculty leaders still have difficulty making decisions.

In the research on the selection of the best prosecutors, the evaluation criteria were used in terms of orientation, service, integrity, commitment, discipline, and cooperation, where these criteria can provide a decision in selecting the best prosecutor according to predetermined requirements [2]. In the selection of outstanding students, institutions must make the right decisions to ensure that the results of student selection are of high quality and can be accounted for. Thus, several criteria and alternatives are needed to assist the data processing process in selecting outstanding students at the institutional level [3].

A decision support system is a computer-based system that supports semi-structured decisions by utilizing data, which is then processed into information as proposals for decisions [4]. The decision support system is also a tool for decision-makers, especially faculty leaders, to expand their capabilities, but it does not replace the assessment results . In research conducted by the author using the Analytical Hierarchy Process (AHP) method in selecting the best faculty staff.

The analytical hierarchy process method is a structured and comprehensive decision-making method. The AHP method was developed by Thomas L. Saaty [5][6]. The AHP method helps solve complex problems with a hierarchical structure of criteria [7][8]. The AHP method gives a subjective value to the importance of each variable and determines the variable that has the highest priority so that it can influence the results of conditions in solving a problem [9][10]. The AHP method can also solve very complex or unclear problems [5][11].

In applying the AHP method, each criterion and alternative will be compared based on their level of importance [12][13]. A comparative assessment of interests between criteria and alternatives provides a value or weight in the form of a number, so that it can be determined which is a priority and which is not a priority based on the results of ranking priority weights [14][15]. The AHP method becomes a decision model for building ideas from problems so as to get the desired solution [16][17]. The advantage of the AHP method is that it provides a model that is easy for users to understand when solving structured problems and a system model for complex problems [18][19].

The research was conducted to determine the application of the Decision Support System in determining the selection of the best faculty staff and to determine the application of the Analytical Hierarchy Process (AHP) method based on the weight of qualitative and alternative criteria. The weighting is converted into quantitative data based on pairwise comparisons using the AHP method [20].

Based on previous research, the Decision Support System for Selecting the Best Prosecutor Using the MABAC Method [2] has been successfully carried out, where previously the prospective prosecutors were grouped based on several criteria using the MABAC method. The difference with the research being conducted is that it is grouping the best faculty and staff candidates so that they are right on target using the AHP method. In the research, the AHP method can be determined based on grouping, where the data is obtained from the results of the weight of each criterion that has been carried out [17].

2. Method

Figure 1 shows the research method used in determining the best faculty staff using the Analytical Hierarchy Process (AHP) method in decision-making.

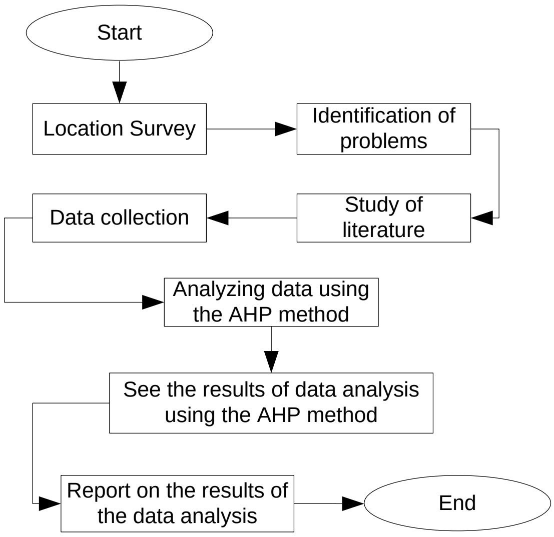

Figure 1. Research Methods

The following is an explanation in Figure 1 of the research method, namely [21]:

a. Location Survey
   Researchers conducted a survey of four staff members of the Faculty of Information Technology and Business at IT Telkom Surabaya [22].
b. Identification of Problems
   Researchers identify problems in determining the best faculty staff and find the best desired solution.
c. Study of Literature
   Researchers studied various theories related to the Analytical Hierarchy Process (AHP) method from various reference sources, including journals, proceedings, and books, over the course of the last 5 years.
d. Data Collection
   Researchers collected data from various sources by conducting direct interviews with faculty staff regarding the process of selecting the best faculty.
e. Analyzing data using the AHP method
   Researchers conducted data analysis and data processing using the AHP method based on the weights and criteria used. The data analysis used is in the form of quantitative analysis as a basis for decision-making to determine the best alternative.

The Analytical Hierarchy Process method is a decision support tool for solving complex multi-factor or multi-criteria problems in a hierarchy [23]. With a hierarchy, complex problems can be described by group, so problems are more structured and systematic [24]. The following are the steps in using the Analytical Hierarchy Process (AHP) method [25]

1) Define the problem and determine the best solution.
2) Create a hierarchical structure starting with general objectives, followed by determining criteria and alternative choices.

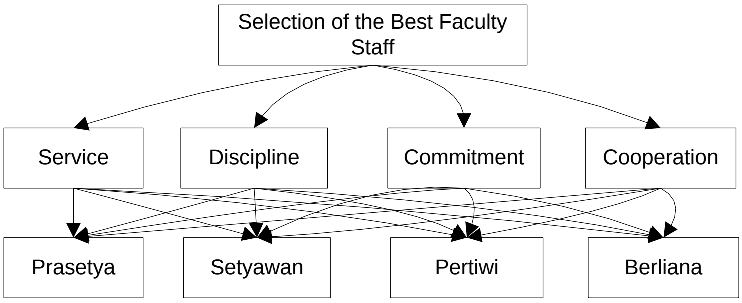

Figure 2. Hierarchical structure of Selection of the Best Faculty Staff

3) Create a pairwise comparison matrix. Comparisons are made based on the choice of the decision-maker by assessing the level of importance of an element compared to other elements. Table 1 is an example of a pairwise comparison matrix [1]. Where the pairwise comparison process starts from the highest level hierarchy to select criteria in column C. Then at the lowest level, the elements to be compared are taken, for example, *A1, A2, A3,* and *An* [1].

Table 1. Perban
Pairwise comparison matrix

C	A_1	A_2	…	A_n
A_1	a_{11}	a_{12}	…	a_{1n}
A_2	a_{21}	a_{22}	…	a_{2n}
:	:	:	…	:
A_m	a_{m1}	a_{m2}	…	a_{mn}

4) Define pairwise comparisons so that the total number of assessors is $\boldsymbol{n\ x}\left[\left(\frac{\boldsymbol{n-1}}{\boldsymbol{2}}\right)\right]$, where n is the number of elements being compared. Table 2 is a pairwise comparison ranking scale, according to Saaty [26].

Table 2.
Pairwise comparison rating scale

Interest Intensity	Information
1	Both elements are equally important (Equal important).
3	One element is slightly more important than the other elements (Moderate mo importance).
5	One element is more important than the other elements (Essential, strong more importance).
7	One element is more important than another elements (Demontrate importance).
9	One element is absolutely more important than the other elements (Absolutely more importance).
2,4,6,8	The values between the two adjacent consideration values (Grey area).
Opposite	If activity *i* gets one point compared to activity j, then j has the opposite value compared to *i*.

5) Calculate the eigenvalues and test for consistency. If it is inconsistent, then the data collection is repeated.
6) Repeat steps 3, 4, and 5 for all hierarchical levels.
7) Calculate the eigenvectors of each pairwise comparison matrix. The weight of each element is used to prioritize the elements at the lowest hierarchical level to reach the goal.

The calculation is done by adding up the values of each column to obtain a normalized matrix and by adding up the values from each row and dividing by the number of elements to get the average.

If A is a pairwise comparison matrix, then the weight vector takes the form:

$$(\boldsymbol{A})\ (\boldsymbol{w^T}) = (\boldsymbol{n})\ (\boldsymbol{w^T}) \tag{1}$$

Can be known by :

1) Normalize each column j in matrix A, so we get:

$$\textstyle\sum_i \boldsymbol{a(i,j)} = \mathbf{1} \tag{2}$$

referred to as A'

2) Compute the average value for each row i in A':

$$\boldsymbol{w_i} = \frac{\mathbf{1}}{\boldsymbol{n}}\textstyle\sum_i \boldsymbol{a(i,j)} \tag{3}$$

Where $\boldsymbol{w_i}$ is the i-th objective weight of the weight vector.

8) Check the consistency of the hierarchy

For example, if A is the pairwise comparison matrix and w is the weight vector, then the consistency of the weight vector w can be tested as follows:

1) **Calculate: (A)(wT)**

$$\boldsymbol{t} = \frac{\mathbf{1}}{\boldsymbol{n}}\sum_{i=1}^{n}\left(\frac{\textbf{the i-element in } (A)(w^T)}{\textbf{the i-element in } w^T}\right) \tag{4}$$

Formula 1. Consistency of Weight Vectors

2) **Calculate the consistency index:**

$$\boldsymbol{CI} = \frac{\boldsymbol{t-n}}{\boldsymbol{n-1}} \tag{5}$$

Formula 2. Index Consistency

3) The random index RI_n is the mean value of a randomly selected CI at A and is given as:

n	2	3	4	5	6	7	8
RI_n	0	0.58	0.90	1.12	1.24	1.32	1.41

4) Calculate the consistency ratio :

$$\boldsymbol{CR} = \frac{\boldsymbol{CI}}{\boldsymbol{RI_n}} \tag{6}$$

If CI = 0, then the hierarchy is consistent.
If CR < 0.1, then the hierarchy is quite consistent.
If CR > 0.1, then the hierarchy is very inconsistent.

5) The final result is in the form of priority as a value used by decision-makers based on the highest score in selecting the best faculty staff.

f. See the results of data analysis using the AHP method
Research using the AHP method starts with problem identification, determines the desired solution, creates a hierarchical structure, continues with criteria and alternative choices, creates a pairwise comparison matrix, normalizes data, calculates eigenvector values, tests consistency, and tests hierarchical consistency.

g. Report on the results of the data analysis.
The researcher made a report based on the results of data analysis on the selection of the best faculty staff using the AHP method.

3. Results and Analysis

3.1 Problem Analysis

In the process of assessing the best faculty using the Analytical Hierarchy Process (AHP) method, it is necessary to calculate the criteria and weight values. The criteria used in this research are service, discipline, commitment, and cooperation.

3.2 Criteria Weighting

The pairwise comparison matrix uses numbers to represent the relative importance of one element to another. The value of the column element assessed is obtained from the quotient with the value of the assessed criteria. If a criterion in one row meets the same criteria in one column, then the value of the element is 1. Table 3 shows the paired scoring matrices for each of the service, discipline, commitment, and cooperation criteria. The service criteria get a score of 1.95, the discipline criteria get a score of 3.83, the commitment criteria get a score of 8, and the cooperation criteria get a score of 10.

Table 3.
Paired Matrix Criteria

Goal	Service	Discipline	Commitment	Cooperation
Service	1	2	4	5
Discipline	0.5	1	2	3
Commitment	0.25	0.5	1	1
Cooperation	0.2	0.33	1	1
Total	1.95	3.83	8	10

In the normalization matrix calculation process, use the formula for each column element divided by the number of matrix columns, then add up each row and column. The eigenvector values are obtained from the number of normalized lines divided by the number of criteria. Table 4 shows the matrix normalization of each criterion. In terms of service criteria, the result is 1.94, and the vector eigenvalue is 0.485. In the disciplinary criteria, the result is 0.98, and the vector eigenvalue is 0.245. The commitment criterion is 0.49, and the vector eigenvalue is 0.122. Meanwhile, the cooperation criterion is in the form of a result of 0.44, and the vector eigenvalue is 0.11.

Table 4.
Matrix Normalization Criteria

Goal	Service	Discipline	Commitment	Cooperation	Amount	Eigen Vector
Service	0.44	0.51	0.48	0.51	1.94	0.485
Discipline	0.22	0.26	0.24	0.26	0.98	0.245
Commitment	0.11	0.13	0.12	0.13	0.49	0.122
Cooperation	0.09	0.10	0.15	0.10	0.44	0.11

Testing the consistency of each matrix-paired criteria λ_{maks} = ((2.25*0.485)+(3.9*0.245)+(8.25*0.122)+(9.75*0.11)) = 4.12575.

$$CI = \left(\frac{(\lambda_{maks} - n)}{(n-1)}\right) = \left(\frac{(4.12575 - 4)}{(4-1)}\right) = \left(\frac{0.12575}{3}\right) = 0.0419$$

$$\boldsymbol{CR = \left(\frac{CI}{RI}\right) = \left(\frac{0.0419}{0.90}\right) = 0.0466}$$

Based on the CR calculation, which is 0.0466, the consistency calculation is considered more consistent than inconsistent, due to the fact that CR ≤ 0.1.

3.3 Alternative Weighting

The Tables 5 to 8 are matrix assessments of alternative pairs of each criterion, namely service, discipline, commitment, and cooperation. Table 5 is an alternative paired matrix of service criteria. Where the highest score of the service criteria, namely 8.33, was obtained by Berliana.

Table 5.
Paired Matrix of Service Alternatives

Goal	Prasetya	Setyawan	Pertiwi	Berliana
Prasetya	1	3	2	4
Setyawan	0.33	1	0.67	1.33
Pertiwi	0.5	1.5	1	2
Berliana	0.25	0.75	0.5	1
Total	**2.08**	**6.25**	**4.17**	**8.33**

Table 6 is an alternative paired matrix of discipline criteria. Where the highest score of the discipline criteria, namely 9.75, was obtained by Berliana.

Table 6.
Paired Matrix of Discipline Alternatives

Goal	Prasetya	Setyawan	Pertiwi	Berliana
Prasetya	1	2	4	5
Setyawan	0.5	1	2	2.5
Pertiwi	0.25	0.5	1	1.25
Berliana	0.2	0.4	0.8	1
Total	**1.95**	**3.9**	**7.8**	**9.75**

Table 7 is an alternative paired matrix of commitment criteria. Where the highest score of the commitment criteria, namely 10.17, was obtained by Berliana.

Table 7.
Paired Matrix of Commitment Alternatives

Goal	Prasetya	Setyawan	Pertiwi	Berliana
Prasetya	1	3	2	5
Setyawan	0.33	1	0.67	1.67
Pertiwi	0.5	1.5	1	2.5
Berliana	0.2	0.6	0.4	1
Total	**2.03**	**6.1**	**4.07**	**10.17**

Table 8 is an alternative paired matrix of cooperation criteria. Where the results of the highest score of the cooperation criteria, namely 9.75, were obtained by Pertiwi.

Table 8.
Paired Matrix of Cooperation Alternatives

Goal	Prasetya	Setyawan	Pertiwi	Berliana
Prasetya	1	4	5	2
Setyawan	0.25	1	1.25	0.5
Pertiwi	0.2	0.8	1	0.4
Berliana	0.5	2	2.5	1
Total	**1.95**	**7.8**	**9.75**	**3.9**

3.4 Faculty Staff Performance Assessment Calculation

The calculation process is the same as in the normalized eigenvector calculation process to compare the four criteria, namely service, discipline, commitment, and cooperation. At this stage of the calculation process, the normalized eigenvector values are carried out by switching columns and rows. Table 9 is the result of the assessment of the normalized eigenvector calculations.

Table 9.
Results of the Best Faculty Staff Performance Assessment

	Eigen Vector	Prasetya	Setyawan	Pertiwi	Berliana
Service	0.485	0.4811	0.1685	0.2197	0.1307
Discipline	0.245	0.5171	0.2447	0.1223	0.1159
Commitment	0.122	0.4883	0.1223	0.2328	0.0893
Cooperation	0.11	0.5273	0.1159	0.1426	0.1811
Total		**0.4963**	**0.1893**	**0.1873**	**0.127**

Table 9 shows the results of the assessment that has been carried out for each criterion on four faculty staff employees. After getting the final score, the next step is ranking each alternative, and the results of the ranking are obtained for each alternative, as further shown in Table 10.

Table 10.
Alternative Ranking Order

Ranking	Alternative Name	Total Score
1	Prasetya	0.4963
2	Setyawan	0.1893
3	Pertiwi	0.1873
4	Berliana	0.127

Table 10 shows the result of the ranking value of the selection of the best faculty staff. The ranking results are applied using the AHP method, making it easier for faculty leaders to make decisions. The results of the calculation of the best faculty staff assessment show that the 1st rank was obtained by Prasetya with a value of 0.4963, the 2nd rank was obtained by Setyawan with a value of 0.1893, the 3rd rank was obtained by Pertiwi with a value of 0.1873, and the 4th rank was obtained by Berliana with a value of 0.127.

4. Conclusion

Based on the results of research conducted using the Analytical Hierarchy Process (AHP) method, it can be concluded that there are four assessment criteria carried out to determine the best faculty staff: service, discipline, commitment, and cooperation. Based on calculations using the AHP method for four faculty staff employees, namely Prasetya, Setyawan, Pertiwi, and Berliana, the final result was obtained with the highest score of 0.4963, namely Prasetya. The impact of this research can be used in selecting the best staff but can be developed on a wider scale such as selecting the best leaders and other performance evaluations. The limitations of this study are still using the AHP method, four criteria and four alternative choices of teaching staff. It should be developed so that it can provide varied results.

References

[1] R. Amarullah and R. M. Simanjorang, "Planning Decision Support System Using Building Mall AHP (Analytical Hierarchy Process)," *Jurnal Teknik Informatika C.I.T*, vol. 12, no. 1, pp. 26–33, 2020, [Online]. Available: www.medikom.iocspublisher.org/index.php/JTI

[2] B. Nur Ihwa, N. Silalahi, and R. Kristianto Hondro, "Sistem Pendukung Keputusan Pemilihan Jaksa Terbaik dengan Menerapkan Metode MABAC (Studi Kasus: Kejaksaan Negeri Medan)," *Journal of Computer System and Informatics (JoSYC)*, vol. 1, no. 4, pp. 225–230, 2020.

[3] N. A. Sari, B. Widada, and T. Susyanto, "Sistem Pendukung Keputusan Pemilihan Mahasiswa Berprestasi Menggunakan Metode Analytical Hierarchy Process (AHP)," *Jurnall TIKomSin : Teknologi Informasi dan Komunikasi Sinar Nusantara*, vol. 2, no. 1, pp. 48–55, 2014.

[4] K. Hiekata and Z. Zhao, "Decision Support System for Technology Deployment Considering Emergent Behaviors in the Maritime Industry," *J Mar Sci Eng*, vol. 10, no. 2, pp. 1–15, Feb. 2022, doi: 10.3390/jmse10020263.

[5] S. D. Yulianti, R. Nuraini, M. I. Shalahudin, and M. Hadi Prayitno, "Decision Support System for Selection of Exemplary Students using the Analytical Hierarchy Process (AHP) Method," *Jurnal Teknik Informatika C.I.T Medicom*, vol. 15, no. 2, pp. 96–107, 2023.

[6] M. Tavana, M. Soltanifar, F. J. Santos-Arteaga, and H. Sharafi, "Analytic Hierarchy Process and Data Envelopment Analysis: A Match Made in Heaven," *Expert Syst Appl*, vol. 223, pp. 1–16, Aug. 2023, doi: 10.1016/j.eswa.2023.119902.

[7] E. Purba and H. T. Sihotang, "Decision Support System For Prospective Recipients Of The Healthy Indonesia Card (Kis) In The Village Of Bah Sidua Dua With The Analytical Hierarchy Process (AHP) Method," *Jurnal Mantik*, vol. 3, no. 3, pp. 82–90, 2019.

[8] M. Vojtek and J. Vojteková, "Flood Susceptibility Mapping on a National Scale in Slovakia Using the Analytical Hierarchy Process," *Water (Switzerland)*, vol. 11, no. 2, pp. 1–17, 2019, doi: 10.3390/w11020364.

[9] Ö. Ekmekcioğlu, K. Koc, and M. Özger, "District Based Flood Risk Assessment in Istanbul Using Fuzzy Analytical Hierarchy Process," *Stochastic Environmental Research and Risk Assessment*, vol. 35, no. 3, pp. 617–637, Mar. 2021, doi: 10.1007/s00477-020-01924-8.

[10] K. Gompf, M. Traverso, and J. Hetterich, "Using Analytical Hierarchy Process (AHP) to Introduce Weights to Social Life Cycle Assessment of Mobility Services," *Sustainability*, vol. 13, no. 3, pp. 1–10, Feb. 2021, doi: 10.3390/su13031258.

[11] M. Higgins and H. Benaroya, "Utilizing the Analytical Hierarchy Process to Determine the Optimal Lunar Habitat Configuration," *Acta Astronaut*, vol. 173, pp. 145–154, Aug. 2020, doi: 10.1016/j.actaastro.2020.04.012.

[12] E. Mushtaha, M. Shamsuzzaman, S. A. Abdouli, S. Hamdan, and T. G. Soares, "Application of the Analytic Hierarchy Process to Developing Sustainability Criteria and Assessing Heritage and Modern Buildings in the UAE," *Architectural Engineering and Design Management*, vol. 16, no. 5, pp. 329–355, Sep. 2020, doi: 10.1080/17452007.2019.1693335.

[13] E. Mastrocinque, F. J. Ramírez, A. Honrubia-Escribano, and D. T. Pham, "An AHP-Based Multi-Criteria Model for Sustainable Supply Chain Development in the Renewable Energy Sector," *Expert Syst Appl*, vol. 150, pp. 1–17, Jul. 2020, doi: 10.1016/j.eswa.2020.113321.

[14] A. Khashei-Siuki, A. keshavarz, and H. Sharifan, "Comparison of AHP and FAHP Methods in Determining Suitable Areas for Drinking Water Harvesting in Birjand Aquifer. Iran," *Groundw Sustain Dev*, vol. 10, pp. 1–8, Apr. 2020, doi: 10.1016/j.gsd.2019.100328.
[15] L. M. Sharpe, C. L. Hernandez, and C. A. Jackson, "Prioritizing Stakeholders, Beneficiaries, and Environmental Attributes: A Tool for Ecosystem-Based Management," in *Ecosystem-Based Management, Ecosystem Services and Aquatic Biodiversity*, Springer International Publishing, 2020, pp. 189–211. doi: 10.1007/978-3-030-45843-0_10.
[16] J. Awad and C. Jung, "Extracting the Planning Elements for Sustainable Urban Regeneration in Dubai with AHP (Analytic Hierarchy Process)," *Sustain Cities Soc*, vol. 76, pp. 1–13, Jan. 2022, doi: 10.1016/j.scs.2021.103496.
[17] Nurmalasari and A. Agus Pratama, "Sistem Pendukung Keputusan Pemilihan Supplier Menggunakan Metode Analytical Hierarchy Process (AHP) Pada PT Transcoal Pacific Jakarta," *Jurnal Teknik Komputer*, vol. 4, no. 2, pp. 48–55, 2018, doi: 10.31294/jtk.v4i2.3509.
[18] C. P. C. Senan *et al.*, "Flood vulnerability of a few areas in the foothills of the Western Ghats: a comparison of AHP and F-AHP models," *Stochastic Environmental Research and Risk Assessment*, vol. 37, no. 2, pp. 527–556, Feb. 2023, doi: 10.1007/s00477-022-02267-2.
[19] S. Panchal and A. K. Shrivastava, "Landslide Hazard Assessment Using Analytic Hierarchy Process (AHP): A Case Study of National Highway 5 in India," *Ain Shams Engineering Journal*, vol. 13, no. 3, pp. 1–11, May 2022, doi: 10.1016/j.asej.2021.10.021.
[20] H. Díaz, A. P. Teixeira, and C. Guedes Soares, "Application of Monte Carlo and Fuzzy Analytic Hierarchy Processes for Ranking Floating Wind Farm Locations," *Ocean Engineering*, vol. 245, Feb. 2022, doi: 10.1016/j.oceaneng.2021.110453.
[21] M. S. Ahmad, MonaLisa, and S. Khan, "Comparative Analysis of Analytical Hierarchy Process (AHP) and Frequency Ratio (FR) Models for Landslide Susceptibility Mapping in Reshun, NW Pakistan," *Kuwait Journal of Science*, pp. 1–32, May 2023, doi: 10.1016/j.kjs.2023.01.004.
[22] T. Kristanto, D. Rahmawati, and A. Muzakki, "Penerapan Metode Simple Additive Weighting (SAW) pada Sistem Pendukung Keputusan Seleksi Penerimaan Mahasiswa Baru," *Jurnal Responsif : Riset Sains dan Informatika*, vol. 5, no. 1, pp. 19–25, Feb. 2023, [Online]. Available: https://ejurnal.ars.ac.id/index.php/jti
[23] T. L. Saaty, *The Analytic Hierarchy Process*. New York: McGraw-Hill, 1980.
[24] T. L. Saaty, *Decision Making for Leaders*. Pitsburgh: University of Pitsburgh, 1993.
[25] R. W. Saaty, "The Analytic Hierarchy Process -What It Is and How It Is Used," *Mathematical Modelling*, vol. 9, no. 3–5, pp. 161–176, 1987, doi: 10.1016/0270-0255(87)90473-8.
[26] S. P Lumbantorua, "Decision Support System Of Pandemic Aid Recipiennts Using AHP (Analytical Hierarchy Process) Method," *Jurnal Teknik Informatika C.I.T Medicom*, vol. 13, no. 2, pp. 94–104, 2021.