Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) Method for Decision Support System in Top Management

Robbi Rahim[1], Andysah Putera Utama Siahaan[2], Rian Farta Wijaya[2], H Hantono[3], Novita Aswan[4], Suyono Thamrin[5], Deffi Ayu Puspito Sari[6], Susanti Agustina[7], Rochmat Budi Santosa[8], Wildan Mahir Muttaqin[9], S Sujito[9], Y Yulia[10], Rhini Fatmasari[11], Afiful Ikhwan[12], Irwan Sugiarto[13], Agung Purnomo[14], Fatkul Anam[15], Nieke Monika Kulsum[16], Prety Diawati[17], Risno Mina[18], S Sujarwo[19]

[1]*Sekolah Tinggi Ilmu Manajemen Sukma, Medan, Indonesia*
[2]*Universitas Pembangunan Pancabudi, Medan, Indonesia*
[3]*Department of Accounting, Universitas Prima Indonesia, Medan, Indonesia*
[4]*Universitas graha nusantara padangsidimpuan, Padangsidimpuang, Indonesia*
[5]*Defense Technology Program Study, Indonesia Defense Security, Indonesia*
[6]*Environmental Engineering, Universitas Bakrie, Jakarta, Indonesia*
[7]*Susanti Agustina, Universitas Pendidikan Indonesia, Indonesia*
[8]*Rochmat Budi Santosa, Department of English Education, IAIN Surakarta, Indonesia*
[9]*Wildan Mahir Muttaqin, Department of English Language Education, IAIN Surakarta*
[9]*S Sujito, Department of English Language Education, IAIN Surakarta, Indonesia*
[10]*Yulia, Universitas Bangka Belitung, Indonesia*
[11]*Rhini Fatmasari, Fakultas Keguruan dan Ilmu Pendidikan Universitas Terbuka Jakarta, Indonesia*
[12]*Afiful Ikhwan, Muhammadiyah University of Ponorogo, East Java, Indonesia*
[13]*Irwan Sugiarto, Sekolah Tinggi Hukum Bandung, Bandung, Indonesia*
[14]*Agung Purnomo, Entrepreneurship Program, Bina Nusantara Institute of Creative Technology Malang, Indonesia*
[15]*Fatkul Anam, Mathematics Education Program, Universitas Wijaya Kusuma Surabaya, Indonesia*
[16]*Universitas Nasional, Indonesia*
[17]*Politeknik Pos Indonesia, Bandung, Indonesia*
[18]*Faculty of Law, Universitas Muhammadiyah Luwuk Banggai, Sulawesi Tengah, Indonesia*
[19]*Department of English Education, Sekolah Tinggi Ilmu Keguruan dan Ilmu Pendidikan Mega Rezky, Makassar, Indonesia*
**Corresponding author E-mail: usurobbi85@zoho.com*

Abstract

Decision support system for determining employee bonuses is a form of decision support system that has several criteria. Determination of employee bonuses is quite difficult because it relates to the objectivity of the leadership in determining which employees are entitled to receive bonuses, to assist leaders in making decisions can be used certain methods in this case the Technique for Order of Preference method by Similarity to Ideal Solution (TOPSIS) as a decision support system method used. The use of the TOPSIS method is expected to provide the best recommendations for leaders to provide bonuses to employees.

Keywords: *Decision Support System, DSS, TOPSIS, Employee Bonus*

1. Introduction

In every company, agency, organization or business entity will provide a salary as compensation for the work of an employee, in addition to providing basic salaries to its employees, each agency often provides bonuses in addition to basic salaries to boost employee performance and productivity, because an employee who receives the bonus must meet certain criteria related to discipline, performance, and productivity as determined by each agency or company. For every business that has used a computer-based information system in its business activities[1], [2], it requires a decision support system to determine which employees have priority to get bonuses based on predetermined criteria. This decision support system can also be useful to monitor employee performance over time[3]–[5].

In solving this problem using the Technique for Order of Preference method by Similarity to Ideal Solution (TOPSIS)[6]–[8] to describe the weights that match the criteria that are worth reconditioning. This system is not intended to replace the function of a leader in making decisions but only to assist in taking a decision more quickly and precisely, according to the desired criteria or at least close to the desired criteria. Choice alternatives are expected to provide a list of references to decision makers before actually taking a final decision. This decision support system uses the

Technique for Order of Preference method by Similarity to Ideal Solution (TOPSIS) which is a method of giving priority (priority) in multi-criteria analysis. Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) is part of the Multi-Attribute Decision Making (MADM)[6], [9] concept which requires normalization in the calculation. By using the Technique for Order of Preference method by Similarity to Ideal Solution (TOPSIS), decision support system software can be developed that can be used by an agency. The criteria are Absence, Achievement, Behavior, Discipline and Team Socialization.

2. Methodology

Decision is an activity of choosing a strategy or action in problem solving. The act of choosing a strategy or action that the manager believes will provide the best solution[10]–[14]. The right to make decisions is essentially the same as the right to make plans. The task of making decision levels is equivalent to the task of taking plans in the organization.

Decision making is the leader's action to solve problems faced by the organization he leads by choosing one of the possible alternatives[15], [16]. Indeed, in essence, decision making is a systematic approach to the nature of alternatives faced, and taking actions that according to calculation are the most appropriate actions. Decision making holds the role of tang is very important because the decisions taken by the leader are the final thought that must be carried out by his subordinates or those who are associated with the organization led[17], [18]. Decision making is a thought process in order to solve a problem to get the final result to be implemented.

2.1. Fuzzy Multi-Attribute Decision Making (Fmadm)

Fuzzy Multi-Attribute Decision Making (FMADM)[9], [19], [20] is a method used to find optimal alternatives from a number of alternatives with certain criteria. Based on the data type used in each alternative performance, FMADM can be divided into three groups, namely all data used is fuzzy data, all data used is crisp data, or the data used is a mixture of fuzzy and crisp data.

2.2. Topsis

TOPSIS is one of the multi-criteria decision-making methods first introduced by Yoon and Hwang. TOPSIS uses the principle of positive ideal solutions and negative ideal solutions from a geometric point of view using Euclidean distance[5], [21], [22].

Positive ideal solutions are defined as the sum of all the best values that can be achieved for each attribute, while the ideal negative solution consists of all the worst values achieved for each attribute.

Based on comparisons with relative distances, alternative priority arrangements can be achieved. This method is widely used to solve practical decisions. TOPSIS is widely used for reasons:

a. The concept is simple and easy to understand
b. Having the ability to measure the relative performance of decision alternatives in a simple mathematical form.

The TOPSIS method is based on the concept that the best chosen alternative does not only have the shortest distance from the positive ideal solution but also has the longest distance from the negative ideal solution[6], [8]. Stage of the TOPSIS method:

a. Make a normalized decision matrix
b. Make a normalized decision matrix weighted
c. Determine the positive ideal solution matrix and the negative ideal solution matrix
d. Determine the distance between the values of each alternative with the positive and negative ideal solution matrix
e. Determine preference values for each alternative

TOPSIS advantages:

a. The concept is simple and easy to understand;
b. Efficient computation; and
c. Has the ability to measure the relative performance of decision alternatives in a simple mathematical form.

TOPSIS Weakness:

There must be a weight calculated using AHP to continue the next data count using TOPSIS.

3. Results and Discussion

A company often has difficulty in getting a decision to calculate and determine the bonus of its employees, to solve problems experienced by the company so that the company does not experience errors in the assessment and justice in giving bonuses to the assessment for employees, the system built is a support system for bonus award decisions Employees using the Technique for Order of Preference method by Similarity to Ideal Solution (TOPSIS). Then set several criteria including Absence, Behavior, Experience and Team Work.

The first step is to determine criteria as seen in table 1 and using 20 Alternative.

Table 1: Criteria

Criteria		Description
C1	Absence	The number of absences made by employees
C2	Behavior	Percentage of attitudes done by employees
C3	Experience	The number of products that are successfully packed by employees / day
C4	Team Work	Percentage level of team collaboration

The completion step in the application of the Fuzzy Multiple Attribute Decision Making (FMADM) method with the TOPSIS method includes:

1. Giving the value of each alternative to each predetermined criterion.

a. The weight of each of these criteria will be determined. The weights consist of five fuzzy numbers, namely bad (B1), Less (K), Enough (C), Good (B2) and Very Good (SB), as shown in table 2.

Table 2: Absence Criteria

Range	Fuzzy Value	Weight
0	Very Good	5
1-3	Good	4
4-6	Enough	3
6-8	Bad	2
8-10	Very Bad	1

b. Fuzzy Behavior Criteria (K2)

The weight of each of these criteria will be determined. The weight consists of five fuzzy numbers, namely bad (B1), Less (K), Sufficient (C) Good (B2) and Very Good (SB). Determining the Behavior criteria formed in table 3.

Table 3: Behavior Criteria

Range (%)	Fuzzy Value	Weight
>=90	Very Good	5
70 – 89	Good	4
60-79	Enough	3
40- 59	Bad	2
>30	Very Bad	1

c. Fuzzy Discipline Criteria (K5)

The weight of each of these criteria will be determined. The weight consists of four fuzzy numbers, namely bad (B1), Less (K), Sufficient (C), Good (B2) and Very Good (SB). To be clearer, determine the disciplinary criteria formed in table 4.

Table 4: Discipline Criteria

Range (%)	Fuzzy Value	Weight
>=90	Very Good	5
70 – 89	Good	4
60-79	Enough	3
40- 59	Bad	2
>30	Very Bad	1

d. Fuzzy Value Criteria for Team Work(K7)

The weight of each of these criteria will be determined. The weight consists of five fuzzy numbers, namely bad (B1), Less (K), Good (B2) and Very Good (SB). To be clearer, determine the criteria for Team Socialization formed in table 5.

Table 5: Teamwork Criteria

Range (%)	Fuzzy Value	Weight
>= 85	Very Good	5
75-84	Good	4
65-74	Enough	3
55-64	Bad	2
>40	Very Bad	1

Furthermore, making a decision gives the Preference Weight for each criterion as W is seen in table 6.

Table 6: Value Determination

Criteria	Range (%)	Weight
C1	30	0,3
C2	25	0,25
C3	20	0,2
C4	15	0,15

Value data from each alternative can be seen in table 7.

Table 6: Alternative Value

No	Alternative	Criteria			
		C1	C2	C3	C4
1	A1	5	80	70	80
2	A2	4	65	55	43
3	A3	2	70	65	85
4	A4	1	50	70	77
5	A5	0	75	80	40
6	A6	1	90	81	40
7	A7	0	75	56	15
8	A8	0	90	68	85
9	A9	4	45	70	40
10	A10	1	56	77	85
11	A11	2	79	80	25
12	A12	0	50	55	80
13	A13	0	55	90	83
14	A14	1	68	40	45
15	A15	1	77	25	50
16	A16	2	85	60	60
17	A17	4	81	80	70
18	A18	2	40	75	85
19	A19	3	60	45	59
20	A20	1	65	50	85

Based on the use of the TOPSIS method, the assessment results are obtained as follows:

Table 7: Alternative Value Weight

No	Alternative	Weight
1	A1	0,439652
2	A2	0,30949
3	A3	0,411668
4	A4	0,69051
5	A5	0,475685
6	A6	0,276486
7	A7	0,2943
8	A8	0,378402
9	A9	0,22032
10	A10	0,406047
11	A11	0,411668
12	A12	0,430254
13	A13	0,800981
14	A14	0,515746
15	A15	0,577268
16	A16	0,421828
17	A17	0,388932
18	A18	0,537239
19	A19	0,419955
20	A20	0,69051

Table 8: Alternative to be recommended

No	Alternative	Weight
1	A13	**0,800981**
2	A4	**0,69051**
3	A20	**0,69051**
4	A15	**0,577268**
5	A18	**0,537239**

4. Conclusion

Based on the results of the research that the author did regarding the implementation of TOPSIS method for decision support process of recipients of disciplinary bonuses that have been designed, the authors conclude that the process of determining the criteria for employee bonus recipients used is absent, behavior, achievement, teamwork quite effective to provide recommendations for leaders to make decisions.

References

[1] D. Napitupulu *et al*., "Analysis of Student Satisfaction Toward Quality of Service Facility," *J. Phys. Conf. Ser*., vol. 954, no. 1, p. 012019, Jan. 2018.

[2] A. H. Lubis, S. Z. Syed Idrus, and A. Sarji, "ICT Usage Amongst Lecturers and Its Impact Towards Learning Process Quality," *J. Komunikasi, Malaysian J. Commun*., vol. 34, no. 1, pp. 284–299, Mar. 2018.

[3] D. Siregar *et al*., "Multi-Attribute Decision Making with VIKOR Method for Any Purpose Decision," *J. Phys. Conf. Ser*., vol. 1019, p. 012034, Jun. 2018.

[4] T. Suryanto, R. Rahim, and A. S. Ahmar, "Employee Recruitment Fraud Prevention with the Implementation of Decision Support System," *J. Phys. Conf. Ser*., vol. 1028, no. 1, p. 012055, Jun. 2018.

[5] R. Rahim *et al*., "TOPSIS Method Application for Decision Support System in Internal Control for Selecting Best Employees," *J. Phys. Conf. Ser*., vol. 1028, no. 1, p. 012052, Jun. 2018.

[6] A. Indahingwati, M. Barid, N. Wajdi, D. E. Susilo, N. Kurniasih, and R. Rahim, "Comparison Analysis of TOPSIS and Fuzzy Logic Methods On Fertilizer Selection," *Int. J. Eng. Technol*., vol. 7, no. 2.3, pp. 109–114, 2018.

[7] S. Syamsudin and R. Rahim, "Study Approach Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS)," *Int. J. Recent Trends Eng. Res*., vol. 3, no. 3, pp. 268–285, Apr. 2017.

[8] G. Ginting, Fadlina, Mesran, A. P. U. Siahaan, and R. Rahim, "Technical Approach of TOPSIS in Decision Making," *Int. J. Recent Trends Eng. Res*., vol. 3, no. 8, pp. 58–64, 2017.

[9] S. H. Sahir, R. Rosmawati, and R. Rahim, "Fuzzy model tahani as a decision support system for selection computer tablet," *Int. J. Eng. Technol*., vol. 7, no. 2.9, pp. 61–65, 2018.

[10] T. L. Saaty, "Decision making — the Analytic Hierarchy and Network Processes (AHP/ANP)," *J. Syst. Sci. Syst. Eng*., vol. 13, no. 1, pp. 1–35, Mar. 2004.

[11] R. Khorshidi and A. Hassani, "Comparative analysis between TOPSIS and PSI methods of materials selection to achieve a desirable combination of strength and workability in Al/SiC composite," *Mater. Des*., vol. 52, no. June, pp. 999–1010, 2013.

[12] P. G. W. Keen, "Decision support systems: a research perspective," *Decis. Support Syst. Issues Challenges Proc. an Int. Task Force Meet*., pp. 23–44, 1980.

[13] M. D. T. P. Nasution *et al*., "Decision Support Rating System with Analytical Hierarchy Process Method," *Int. J. Eng. Technol*., vol. 7, no. 2.3, pp. 105–108, 2018.

[14] D. Siregar, D. Arisandi, A. Usman, D. Irwan, and R. Rahim,

"Research of Simple Multi-Attribute Rating Technique for Decision Support," *J. Phys. Conf. Ser.*, vol. 930, no. 1, p. 012015, Dec. 2017.
[15] V. Chichernea, "THE USE OF DECISION SUPPORT SYSTEMS (DSS) IN SMART CITY PLANNING AND MANAGEMENT," *J. Inf. Syst. Oper. Manag.*, pp. 1–14, 2014.
[16] A. Spyridakos, N. Tsotsolas, J. Mellios, Y. Siskos, D. Yannakopoulos, and P. Kyriazopoulos, "SAINC: Self-adapting inventory control decision support system for cement industries," *Oper. Res.*, vol. 9, no. 2, pp. 183–198, 2009.
[17] M. Min, "A rule based expert system for analysis of mobile sales data on fashion market," in *2013 International Conference on Information Science and Applications, ICISA 2013*, 2013.
[18] A. A. Esfahani *et al.*, "An evaluation model for the implementation of hospital information system in public hospitals using multi-criteria-decision-making (MCDM) approaches," *Int. J. Eng. Technol.*, vol. 7, no. 1, p. 1, Dec. 2017.
[19] F. Haswan, "Decision Support System For Election Of Members Unit Patients Pamong Praja," *Int. J. Artif. Intell. Res.*, vol. 1, no. 1, p. 21, Jun. 2017.
[20] P. harliana and R. Rahim, "Comparative Analysis of Membership Function on Mamdani Fuzzy Inference System for Decision Making," *J. Phys. Conf. Ser.*, vol. 930, no. 1, p. 012029, Dec. 2017.
[21] S. Opricovic and G. H. Tzeng, "Compromise solution by MCDM methods: A comparative analysis of VIKOR and TOPSIS," *Eur. J. Oper. Res.*, vol. 156, no. 2, pp. 445–455, 2004.
[22] Rasim, E. F. Rahman, N. F. Dewi, and L. S. Riza, "Decision Support Systems for Performance and Evaluation of Teachers in General-English Course by Using the SMARTER and TOPSIS Methods," *IOP Conf. Ser. Mater. Sci. Eng.*, vol. 180, no. 1, p. 012283, Mar. 2017.