Decision Support System for Determination of Promotion Using Simple Additive Weighting

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A R T I C L E I N F O

A B S T R A C T

The human resources of a company greatly influence many aspects that determine the success of the work of the company. One of the most important processes in the human resources department of a company or business entity is the promotion process. When determining which employees are eligible for promotion, it is difficult for companies to make a decision. This is because many employees are highly qualified and the number of positions required is limited. In addition, the processing of employee evaluation data in companies is still done manually, so that considering a large number of employees, the possibility of input errors is quite high and takes a relatively long time. For that, we need a decision support system that can assist companies in selecting employees to be promoted to various positions. The method used is the Simple Additive Weighting method, which starts from finding problems, determining goals, determining standards and alternatives, determining weights until the final result is obtained, then carrying out a ranking process, which will select the alternatives given so that employees who deserve to be promoted can be determined.

1. Introduction

PT. MNC Vision Jakarta was founded on August 8, 1988. PT. MNC Vision Jakarta began selling its services in early 1994 and is responsible for marketing management plans and services to customers. It is carried out on a business foundation that is built through the consistent implementation of the principles of good corporate governance (Good Corporate Governance, GCG) and is supported by a strong, honest, disciplined, responsive, careful, and polite corporate culture. PT. MNC Vision Jakarta is getting more and more trust from customers and business partners so that they are increasingly confident that they will be able to fly themselves to become the leading subscription television company in Indonesia in accordance with the company's vision. A company must-have resources, there are five main types of company resources, namely people, materials, machines (including facilities and energy), money, and information (including data).

Human resources in corporate organizations are very important [1] [2] [3] to support the progress and quality of the company in achieving its goals [4]. One of the keys to improving employee performance is providing motivation through promotion to employees [5] [6] who are considered capable and capable of carrying out the assigned tasks in accordance with the available positions [7]. Promotion is one of the most important factors in employee career planning and promotion [8] so that positions can be held by people with suitable conditions [9].

It is often difficult to fill vacant positions during the promotion process because it is not possible to define potential candidates who can occupy the position by matching employee profiles and job profiles well [10]. Usually, the promotion and career planning process of a company is only based on certain factors, namely the length of employment, performance evaluation, behavior evaluation, and level of education [11].

In determining which employees are eligible for promotion, it is difficult for companies to make decisions. This is because many employees are highly qualified and the number of positions required is limited [12]. In addition, the processing of employee appraisal data in companies is still done manually [13], so that input errors are likely to occur considering a large number of employees and it takes a relatively long time [3]. Another thing that becomes an obstacle is the problem of subjectivity in employee performance appraisal which is almost inevitable [14]. Therefore, in processing employee evaluation data, a decision

support system is needed that can assist supervisors and the HRD department in making decisions regarding employee promotions [15].

The design of a decision support system is expected to provide results for solving subjective problems in decision making, producing faster solutions and reliable results because it is based on certain data. In this case, the decision support system can greatly assist leaders in selecting suitable human resources to fill vacant positions in previous career planning [16]. Thus the problems that often occur in the selection process can be minimized so that the company's development goals are in line with the desired goals.

The method used is Simple Additive Weighting (SAW), this method is suitable for the decision-making process in identifying prospective employees who are entitled to be promoted because it can determine the weight value of each criterion, then a series of processes are continued to select the best alternative method. Top priority criteria for selecting employees include tenure, performance evaluation, behavior evaluation, and recent education. In addition, compared to other decision-making methods, the advantage of the Simple Additive Weighting method is that it has a more accurate assessment ability because it is based on predetermined value standards and preference weights. The purpose of this study is to simplify and accelerate department head decision making in determining prospective employees who are entitled to be promoted based on predetermined criteria.

2.   Research Methods

In this case, it will describe the steps taken in research which are stages that must be applied so that research can be carried out in a directed manner and makes it easier to analyze existing problems.

The process stages in this research can be seen in Figure 1 below.
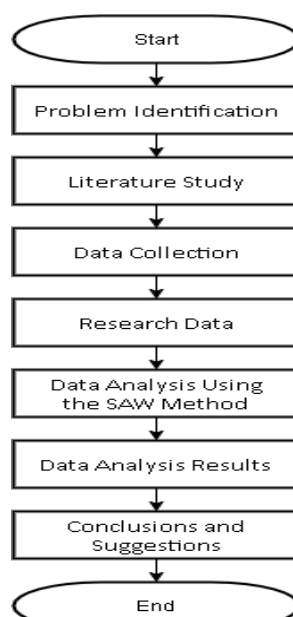
Fig 1. Research Flow

The stages of the research carried out will be explained as follows:
a.   Problem Identification
    The author identifies problems that will be used as the subject of the research discussion. This stage is carried out based on the formulation of the problem which is based on the background of the problem.
b.   Literature Study
    The author studies and understands the theories used in this research. Where the theory is obtained by studying books, research journals, previous theses, and also e-books about decision support systems and SAW methods that will be used as theoretical studies in research.
c.   Data Collection
    The author collects data in 2 ways, namely direct observation to PT. MNC Vision Jakarta regarding the process of determining prospective employees who will be promoted to positions and interviews with the Head of the Technical Service Division of PT. MNC Vision Jakarta regarding the determination of prospective employees who will be promoted to their positions.

d.   Research Data
In this research, the required data is divided into two, namely primary data and secondary data.
e.   Data Analysis Using the SAW Method
The author analyzes the data using the SAW method starting from determining the criteria and alternatives, determining the weight value of each criterion, making a decision matrix, normalizing the decision matrix, making a normalized matrix so that the final result is obtained.
f.   Data Analysis Results
After the data analysis stage is carried out, the authors get the final results obtained from the ranking process that has been carried out using the SAW method.
g.   Conclusions and Suggestions
This stage is the last stage in the description of the research process by concluding and providing suggestions on existing problems.

The population used is the employees of PT. MNC Vision in Jakarta Technical Service Division with a total number of employees of 93 people. By using the Slovin formula which has a critical value of 10%, the required sample size is 48 employees.

In this study, data analysis was carried out using the Simple Additive Weighting (SAW) method. In determining prospective employees who will be promoted to their positions at PT. MNC Vision Jakarta Technical Service Division, the determination is made using several criteria so that an alternative candidate employee who deserves to be promoted will be obtained. To facilitate data processing, a method that can solve problems with many criteria is applied, namely the Simple Additive Weighting (SAW) method, because this method is one of the methods of Fuzzy Multi-Attribute Decision Making (FMADM), so determining the weight of the variable values on each criterion must use fuzzy numbers.

3.   Results and Discussion

There are several steps to perform calculations in determining prospective employees to be promoted using the Simple Additive Weighting (SAW) method.

3.1   Defining Criteria

The first step is to determine the criteria that will be used as a reference in making decisions Cj. The criteria are as follows:
a.   Working Period (C1)
The working period criterion is one of the criteria needed in decision making. Employees with a longer working period will be prioritized for getting a promotion. The description of the criteria for the working periodis shown in the following table:

Table 1
Working Period Criteria

Working Period (C1)	Scale	Value
2 years	Very Low	1
3 years	Low	2
4 years	Normal	3
5 years	High	4
> 5 years	Very High	5

b.   Performance Assessment (C2)
Performance assesment criteria are quite influential in determining prospective employees to be promoted to their positions. Judging from the better the employee's performance, the more likely the employee will be promoted in his position. The description of the performance appraisal criteria is shown in the following table:

Table 2
Performance Assessment Criteria

Performance Assessment (C2)	Scale	Value
E	Very Low	1
D	Low	2
C	Normal	3
B	High	4
A	Very High	5

c.   Behavior Assessment (C3)
Behavior assessment criteria are also needed in determining prospective employees who will be promoted to their positions. Judging from the better the employee's behavior, the more likely the

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employee can be promoted. The description of the behavioral assessment criteria is shown in the following table:

Table 3
Behavior Assessment Criteria

Behavior Assessment (C3)	Scale	Value
E	Very Low	1
D	Low	2
C	Normal	3
B	High	4
A	Very High	5

d. Last Education (C4)

The last education criteria are needed in determining prospective employees to be promoted to positions. Judging from the higher the employee's education, the greater the opportunity to be promoted to a position The description of the latest education criteria is shown in the following table:

Table 4
Last Education Criteria

Last Education (C4)	Scale	Value
SMA	Very Low	1
D3	Low	2
S1	Normal	3

3.2 Determining Alternatives

The second step is to determine the alternative, namely A which is taken from the research sample with a total of 48 employees. But in this case, only a few samples are presented. The following is alternative data that will be used in the calculation.

Table 5
Employees Alternative

No	Employee Name	Working Period	Performance Assessment	Behavior Assessment	Last Education
1	ADE NOOR WIDYA P	> 5 years	A	B	D3
2	AHMAD SUGIARTO	> 5 years	A	B	S1
3	AKHMAD RIZQON	> 5 years	B	A	S1
4	ANGGIT AGUS S	> 5 years	A	B	S1
5	DWI SUPRIYANTO	> 5 years	A	B	D3
6	FACHRUDIN	> 5 years	A	B	D3
7	MAD YUNUS	> 5 years	A	B	D3
8	MUHAMAD ZAINI	> 5 years	A	B	D3
9	SATYA PAMUNGKAS	> 5 years	A	B	D3
10	SUPRIANTO S. P	> 5 years	B	A	S1

3.3 Determining Preference Weights

The third step determines the weight of preference or level of importance (W) based on the level of importance of each required criterion. The weight value of each criterion is shown in the following table:

Table 6
Weighted Value Of Each Criterion

Criteria (C)	Wight
C1 = Working Period	25% = 0,25
C2 = Performance Assessment	35% = 0,35
C3 = Behavior Assessment	25% = 0,25
C4 = Last Education	15% = 0,15

3.4 Determining the Suitability Rating Value of Each Alternative on Each Criterion

The fourth step determines the suitability rating of each alternative on each predetermined criterion. The match rating value can be seen in the following table:

Table 7
Alternative Match Ratings

No	Employee Name	Working Period	Working Period	Working Period	Working Period
1	ADE NOOR WIDYA P	5	5	4	4
2	AHMAD SUGIARTO	5	5	4	5
3	AKHMAD RIZQON	5	4	5	5
4	ANGGIT AGUS S	5	5	4	5
5	DWI SUPRIYANTO	5	5	4	4
6	FACHRUDIN	5	5	4	4

No	Employee Name	Criteria			
		Working Period	Working Period	Working Period	Working Period
7	MAD YUNUS	5	5	4	4
8	MUHAMAD ZAINI	5	5	4	4
9	SATYA PAMUNGKAS	5	5	4	4
10	SUPRIANTO S. P	5	4	5	5

3.5 Creating a Decision Matrix

After the alternative rating value for each criterion is determined, the fifth step is to create a decision matrix (X) which is formed from the suitability rating table of each alternative on each criterion. The X value of each alternative (Aj) on each predetermined criterion (Cj). The results of the decision matrix can be seen as follows:

$$X_{1\text{-}10} = \begin{bmatrix} 5 & 5 & 4 & 4 \\ 5 & 5 & 4 & 5 \\ 5 & 4 & 5 & 5 \\ 5 & 5 & 4 & 5 \\ 5 & 5 & 4 & 4 \\ 5 & 5 & 4 & 4 \\ 5 & 5 & 4 & 4 \\ 5 & 5 & 4 & 4 \\ 5 & 5 & 4 & 4 \\ 5 & 4 & 5 & 5 \end{bmatrix}$$

3.6 Decision Matrix Normalization (X)

The results of the normalization of the alternative decision matrix 1 to alternative 10 are as follows:

Tabel 8
Decision Matrix Normalization

Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
$r11 = \frac{5}{5} = 1$	$r21 = \frac{5}{5} = 1$	$r31 = \frac{5}{5} = 1$	$r41 = \frac{5}{5} = 1$	$r51 = \frac{5}{5} = 1$
$r12 = \frac{5}{5} = 1$	$r22 = \frac{5}{5} = 1$	$r32 = \frac{4}{5} = 0,8$	$r42 = \frac{5}{5} = 1$	$r52 = \frac{5}{5} = 1$
$r13 = \frac{4}{5} = 0,8$	$r23 = \frac{4}{5} = 0,8$	$r33 = \frac{5}{5} = 1$	$r43 = \frac{4}{5} = 0,8$	$r53 = \frac{4}{5} = 0,8$
$r14 = \frac{4}{5} = 0,8$	$r24 = \frac{5}{5} = 1$	$r34 = \frac{5}{5} = 1$	$r44 = \frac{5}{5} = 1$	$r54 = \frac{4}{5} = 0,8$

Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10
$r61 = \frac{5}{5} = 1$	$r71 = \frac{5}{5} = 1$	$r81 = \frac{5}{5} = 1$	$r91 = \frac{5}{5} = 1$	$r101 = \frac{5}{5} = 1$
$r62 = \frac{5}{5} = 1$	$r72 = \frac{5}{5} = 1$	$r82 = \frac{5}{5} = 1$	$r92 = \frac{5}{5} = 1$	$r102 = \frac{4}{5} = 0,8$
$r63 = \frac{4}{5} = 0,8$	$r73 = \frac{4}{5} = 0,8$	$r83 = \frac{4}{5} = 0,8$	$r93 = \frac{4}{5} = 0,8$	$r103 = \frac{5}{5} = 1$
$r64 = \frac{4}{5} = 0,8$	$r74 = \frac{4}{5} = 0,8$	$r284 = \frac{4}{5} = 0,8$	$r94 = \frac{4}{5} = 0,8$	$r104 = \frac{5}{5} = 1$

3.7 Matrix Normalized (R)

The results of the normalized matrix (Rij) form a normalized matrix (R) as follows:

$$R_{1\text{-}10} = \begin{bmatrix} 1 & 1 & 0,8 & 0,8 \\ 1 & 1 & 0,8 & 1 \\ 1 & 0,8 & 1 & 1 \\ 1 & 1 & 0,8 & 1 \\ 1 & 1 & 0,8 & 0,8 \\ 1 & 1 & 0,8 & 0,8 \\ 1 & 1 & 0,8 & 0,8 \\ 1 & 1 & 0,8 & 0,8 \\ 1 & 1 & 0,8 & 0,8 \\ 1 & 0,8 & 1 & 1 \end{bmatrix}$$

3.8 Calculating Preference Value (Vi)

The eighth step calculates the final result of the preference value (Vi) obtained from the sum of the multiplication of each normalized matrix row element (R) with the preference weight (W) corresponding to the matrix column element (R).

Calculating the values V1 to V10 are as follows:

V1 = [(0,25 * 1) + (0,35 * 1) + (0,25 * 0,8) + (0,15 * 0,8)]   = 0,92
V2 = [(0,25 * 1) + (0,35 * 1) + (0,25 * 0,8) + (0,15 * 1)]   = 0,95

$$V3 \;\; = [(0,25 * 1) + (0,35 * 0,8) + (0,25 * 1) + (0,15 * 1)] \qquad = 0,93$$
$$V4 \;\; = [(0,25 * 1) + (0,35 * 1) + (0,25 * 0,8) + (0,15 * 1)] \qquad = 0,95$$
$$V5 \;\; = [(0,25 * 1) + (0,35 * 1) + (0,25 * 0,8) + (0,15 * 0,8)] \qquad = 0,92$$
$$V6 \;\; = [(0,25 * 1) + (0,35 * 1) + (0,25 * 0,8) + (0,15 * 0,8)] \qquad = 0,92$$
$$V7 \;\; = [(0,25 * 1) + (0,35 * 1) + (0,25 * 0,8) + (0,15 * 0,8)] \qquad = 0,92$$
$$V8 \;\; = [(0,25 * 1) + (0,35 * 1) + (0,25 * 0,8) + (0,15 * 0,8)] \qquad = 0,92$$
$$V9 \;\; = [(0,25 * 1) + (0,35 * 1) + (0,25 * 0,8) + (0,15 * 0,8)] \qquad = 0,92$$
$$V10 = [(0,25 * 1) + (0,35 * 0,8) + (0,25 * 1) + (0,15 * 1)] \qquad = 0,93$$

From the results of these calculations, the ranking results can be seen in Table 9.

Tabel 9
Rating Results

No	Employee Name	Criteria				Result
		Working Period	Working Period	Working Period	Working Period	
1	AHMAD SUGIARTO	0,20	0,35	0,20	0,20	0,95
2	ANGGIT AGUS S	0,20	0,35	0,20	0,20	0,95
3	AKHMAD RIZQON	0,20	0,28	0,25	0,20	0,93
4	SUPRIANTO S. P	0,20	0,28	0,25	0,20	0,93
5	ADE NOOR WIDYA P	0,20	0,35	0,20	0,16	0,92
6	DWI SUPRIYANTO	0,20	0,35	0,20	0,16	0,92
7	FACHRUDIN	0,20	0,35	0,20	0,16	0,92
8	MAD YUNUS	0,20	0,35	0,20	0,16	0,92
9	MUHAMAD ZAINI	0,20	0,35	0,20	0,16	0,92
10	SATYA PAMUNGKAS	0,20	0,35	0,20	0,16	0,92

From Table 9 above, it can be seen that the final results of each employee. The employees with the highest results were Ahmad Sugiarto and Anggit Agus Setiawan, who both scored 0.95 and were the best alternatives to get a promotion. However, these results are not the main reference for the Head of the Division as a decision-maker in determining which employees will be promoted to positions. This result is only limited to helping the decision-maker and the final decision remains with the Division Head as the decision-maker.

4. Conclusion

Based on the description that has been discussed, it can be concluded that the Simple Additive Weighting method can provide the best alternative in making decisions to determine prospective employees who are entitled to promotion promotions quickly and precisely. Where the highest final results are Ahmad Sugiarto and Anggit Agus Setiawan who both get the highest score and are the best alternatives to get a promotion to promotion.

5. References

[1] Harriyansah and T. Baidawi, "Sistem Pendukung Keputusan Kenaikan Jabatan Pegawai Negeri Sipil Pada Pusat Penelitian Dan Pengembangan Minyak Dan Gas Bumi Lemigas Kementerian ESDM Dengan Metode Profile Macthing," *J. Tek. Komput.*, vol. 4, no. 1, pp. 217–222, 2018.
[2] F. Rizki and Zulkifli, "Sistem Pendukung Keputusan Promosi Kenaikan Pangkat Jabatan Fungsional Pegawai Terbaik Berdasarkan Nilai Angka Kredit Menggunakan Metode Weighted Product dan Promethee," *Aisyah J. Informatics Electr. Eng.*, vol. 2, no. 1, pp. 83–96, 2020.
[3] T. I. Ayu, R. Ariyanto, and Y. W. Syaifudin, "Sistem Pendukung Keputusan Kenaikan Jabatan Dengan Metode Ahp-Topsis (Studi Kasus: Pt. Makmur Citra Abadi)," *J. Inform. Polinema*, vol. 3, no. 3, p. 9, 2017, doi: 10.33795/jip.v3i3.27.
[4] I. F. Dwijaya, "SISTEM PENDUKUNG KEPUTUSAN KENAIKAN JABATAN PADA PT. SYSMEX MENGGUNAKANMETODE PROFILE MATCHING," *J. Inform.*, 2010, doi: 10.30998/string.v2i3.2437.
[5] K. B. Sanjoyo, N. Dengen, and H. R. Hatta, "Studi Tentang Sistem Pensukung Keputusan Kenaikan Jabatan Struktural Menggunakan Metode Analytical Hierarchy Process (AHP) (Studi Kasus : Pengadilan Tinggi Daerah Provinsi Kalimantan Timur)," *Pros. Semin. Nas. Ilmu Komput. Dan Teknol. Inf.*, vol. 2, no. 2, pp. 31–35, 2017.
[6] J. A. Winarsih and S. Bahri, "Sistem Pendukung Keputusan Penilaian Kinerja Karyawan Untuk Kenaikan Jabatan Pada PT. SMS Cengkareng Barat Dengan Metode Profile Matching," *IJSE – Indones. J. Softw. Eng. Sist.*, vol. 4, no. 1, pp. 85–92, 2018.
[7] H. Cahyono and Y. Yunita, "Sistem Penunjang Keputusan Promosi Jabatan Menggunakan Metode Profile Matching," *IJCIT (Indonesian J. Comput. Inf. Technol.*, vol. 5, no. 1, pp. 31–35, 2020, doi: 10.31294/ijcit.v5i1.6467.
[8] R. Hidayat, "Menentukan Promosi Jabatan Karyawan dengan Menggunakan Metode Profile Matching dan Metode

Promethee," *IJSE - Indones. J. Softw. Eng.*, vol. 2, no. 1, pp. 57–65, 2016, [Online]. Available: http://ejournal.bsi.ac.id/ejurnal/index.php/ijse/article/view/667/558.

[9] Frieyadie, "Penggunaan Metode Profile Matching untuk Sistem Penunjang Keputusan Kenaikan Jabatan pada Instansi Pemerintah," *Paradigma*, vol. XVIII, no. 2, pp. 75–80, 2016.

[10] L. Tanti, "Analisis Promosi Kenaikan Jabatan Berdasarkan Evaluasi Kinerja Pegawai," *Creat. Inf. Technol. J.*, vol. 3, no. 4, p. 331, 2016, doi: 10.24076/citec.2016v3i4.88.

[11] R. I. Handayani and A. Halim, "Analisis Metode Simple Additive Weight (SAW) dalam Promosi Kenaikan Jabatan Pada PT Telkom Cabang Bintaro," *J. Penelit. Tek. Inform.*, vol. 3, no. 1, pp. 67–74, 2018, [Online]. Available: http://jurnal.polgan.ac.id/index.php/sinkron/article/view/155/95.

[12] Y. Malau, "Implementasi Metode Simple Additive Weighting untuk Sistem Pendukung Keputusan Promosi Kenaikan Jabatan," *Paradigma*, vol. 19, no. 1, pp. 38–45, 2017.

[13] F. D. Silalahi and Susanto, "Sistem Pendukung Keputusan Evaluasi Kinerja Karyawan untuk Usulan Gaji dan Promosi Jabatan Berbasis Web Menggunakan Metode AHP pada PT Herculon Carpet," *EBISNIS*, vol. 9, no. 1, pp. 40–44, 2016.

[14] Nurhayati and S. Assehaff, "Analisis dan Perancangan Sistem Pendukung Keputusan Kenaikan Jabatan Struktural pada Kantor Inspektorat Kota Jambi," *J. Manaj. Sist. Inf.*, vol. 3, no. 3, pp. 1176–1188, 2018.

[15] Frieyadie, "Penerapan Metode Simple Additive Weight (SAW) dalam Sistem Pendukung Keputusan Promosi Kenaikan Jabatan," *J. Pilar Nusa Mandiri*, vol. XII, no. 1, pp. 37–45, 2016.

[16] D. Y. S. Putra, "Sistem Pendukung Keputusan dengan Metode Analisis GAP untuk Proses Kenaikan Jabatan dan Perencanaan Karir," *J. ISD*, vol. 2, no. 2, pp. 70–83, 2017.