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Analysis Determination of the Best Employee with Simple Additive Weighting Method

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Abstract. In a company, quality human resources are very important to carry out business processes in accordance with the vision and mission that has been set. CV. Jaya Abadi is a company engaged in the procurement and repair services of various electronic devices and was founded in 2015. The purpose of this research is to encourage the creation of continuously increasing performance productivity by selecting the best employees at CV. Jaya Abadi. One of the methods used is the Simple Additive Weighting (SAW) method. In the SAW method, there is a process of normalizing the decision matrix (x) on a certain scale that can be compared with all existing ratings. In this study, the data used consisted of internal data and external data. There are several criteria that are taken into consideration in selecting the best employees, namely discipline, quality of work, cooperation, and behavior. Based on the calculation of all existing criteria and alternatives, this study resulted in Abiyasa Alfarizi being the best employee with a total preference score of 1.33. The SAW method is proven to be effective and practical in calculating to determine the best employee recommendations at CV. Jaya Abadi. Thus, decision makers can consider these recommendations according to the priorities set.

Keywords: Decision Support System, Selection of the Best Employees, Simple Additive Weighting

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1. Introduction

CV. Jaya Abadi is a private company that was established in 2015 and focuses on procurement and repair services for various electronic devices. CV. Jaya Abadi is a company that is growing and prioritizes quality in the procurement of electronic equipment and repair services. Quality human resources is one of the important factors in running a company or business well [1]. Human resources have a very important role in the field of production, development and progress of a company. If the human resources are of poor quality, it will be difficult for the company to achieve the vision, mission, goals and objectives that have been set [2]. Therefore, human resources must have a variety of competencies that can support and encourage an increase in employee productivity and performance. In addition, it is necessary to provide rewards or awards to employees as motivation to be more positive

and work better [3]. In order to realize this, CV. Jaya Abadi requires an information system that can assist companies in selecting and deciding the best employees effectively according to certain criteria.

One of the previous studies related to the research to be carried out is "Decision Support System for Selection of the Best Employees Using the Analytical Hierarchy Process Method (Case Study at PT. Bando Indonesia)". This study uses the AHP method, in which each criterion and decision alternative is compared to one another to provide a priority intensity value that assesses the performance of outstanding employees.[4]. In addition, researchers also reviewed previous research entitled "The Best Employee Selection Recommendation System with the TOPSIS Method on Bussan Auto Finance". This study used the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) method, which is one of the methods used in making decisions with multi-criteria. The aim is to determine the relative proximity of an alternative that has an optimal solution by selecting the alternative that has the shortest distance from the positive ideal solution and the farthest distance from the negative ideal solution from a geometric point of view.[5].

Through the SAW (Simple Additive Weighting) method, this study aims to simplify CV. Jaya Abadi in selecting the best employees according to the company's criteria[6]. By taking into account preference weights and match ratings, problems in selecting the best employees can be resolved and all alternative ratings can be compared objectively to achieve results that are in line with expectations.[7].

2. Methods

The data used in this study came from external data and internal data collected in several ways, such as searching for data directly in the field, conducting interviews with employees and management of CV. Jaya Abadi, as well as conducting literature studies. The criteria to be used are the alternatives to be compared[8]. There are six alternatives and four criteria that will be analyzed through fuzzy weighting. Furthermore, the data will be processed so that it has a quantitative nature[9]. This study aims to make it easier for companies to choose the best employees according to company criteria using the SAW (Simple Additive Weighting) method and provide objective results and in accordance with expectations[10].

The methods that can be used in decision support systems are quite diverse. One of them is the SAW method, which is a weighted sum method. In the SAW method, there is a process of normalizing the decision matrix (x) on a certain scale that can be compared with all existing ratings[11], as seen in the equation below.

$$r_{ij} = \begin{cases} \dfrac{x_{ij}}{Max\ x_{ij}} \\ \dfrac{Min\ x_{ij}}{x_{ij}} \end{cases}$$

Information:

r_{ij} = normalized performance rating value

x_{ij} = attribute value owned by each criterion

$Max\ x_{ij}$ = the largest value owned by each criterion

$Min\ x_{ij}$ = the smallest value that is owned by each criterion

Where r_{ij} is the normalized performance rating of the Ai alternative on the C_j attribute; i = 1,2,3…,m and j = 1,2,3,…,n. In determining the preference value in each alternative (V_j) the following equation is used:

$$V_i = \sum_{j=1}^{n} w_j \, r_j$$

Information:
V_i = rating for each alternative
W_j = weight value for each alternative
r_{ij} = normalized performance rating value

If Vi has the greatest value, this means that alternative Ai is the best alternative. Figure 1 is a flowchart of the SAW method.

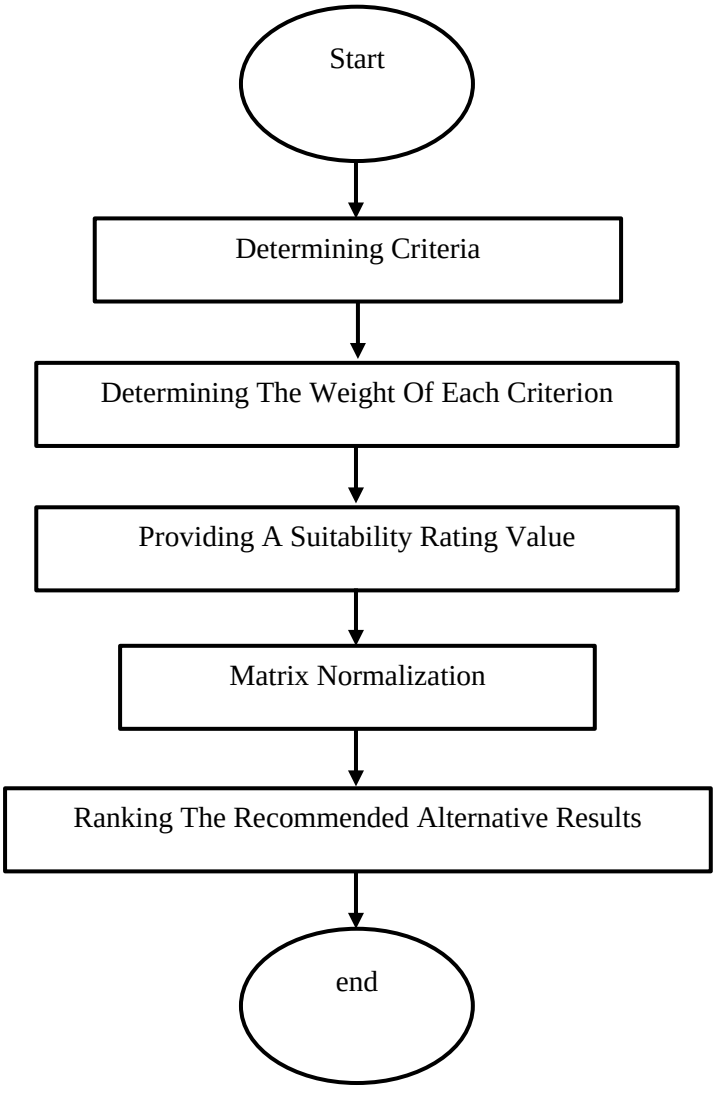

Figure 1.SAW Method Flowchart

Figure 1 is the completion steps using the SAW (Simple Additive Weighting) method based on the SAW method flowchart.

1. A value is given to each alternative (A_i) on each predetermined criterion (C_j), where the value i = 1,2,3,...,m and j = 1,2,3,...,n.

2. The decision maker assigns a weight value (W) to each criterion.
3. Calculation of the normalized performance rating value for attribute C of each alternative Ai is performed to normalize the matrix.
4. The ranking process is carried out by multiplying the preference weight value with the normalized matrix.
5. The preference value is determined by the sum of the multiplication results between the preference weights and the normalized matrix.

In this study, a multi-attribute decision making (MADM) approach was applied to find alternatives that meet certain criteria and are optimal. The MADM approach is carried out in two steps[12]:

1. Aggregating decision alternatives for each objective in each alternative.
2. Ranking the alternatives based on decision aggregation.

The results of this study will provide recommendations for the best employees based on four criteria, namely cooperation, quality of work, discipline, and behavior. This recommendation information will be given to the management of CV. Jaya Abadi to be taken into consideration in selecting the best employees[13]. This process is carried out using the SAW method which processes input from users to produce a list of the best employee recommendations[14].

3. Results and Discussion

3.1. Determination of Criteria

In determining the best employee using the SAW method, the first step is to determine the criteria and weights[15]. These criteria are obtained from the results of observations at CV. Jaya Abadi. In Table 1 and Table 2 are the criteria and alternatives that have been obtained in determining the best employees:

Table1. Criteria

No		Criteria
1	C1	Discipline
2	C2	Quality of Work
3	C3	Cooperation
4	C4	Behavior

Table2. Alternatives

No		Alternatives
1	A1	Wahyu Ardito
2	A2	Jamaluddin
3	A3	Nana Triahapsari
4	A4	Rani Febriyana
5	A5	Abiyasa Alfarizi
6	A6	Ahmad Chaerudin

In table 3 there are 5 (five) Fuzzy numbers for criterion weights, namely:

Table3. Fuzzy Numbers

No	Weight	Information	linguistics
1	1	Very Low	VL
2	2	Low	L
3	3	Moderate	M
4	4	high	H
5	5	Very High	VH

3.2. Determination of Weigh of Each Criterion

Before determining the best employees using the SAW method, it is necessary to determine the criteria and weights first. These criteria were obtained through observations at CV. Jaya Abadi. The following are the criteria and alternatives that have been obtained to determine the best employees. There are 2 weightings used in this system, namely the importance level weighting and the suitability level weighting contained in each alternative. Match level weighting aims to simplify data processing and then convert it into a fuzzy form. The following is the weighting for each criterion.

Table 4 is a nursery with criteria C1, C2, C3, C4, – Discipline, Quality of Work, Cooperation, Behavior

Table4. Weighting Value

No	Mark	Information
1	0.35	Discipline
2	0.35	Quality of Work
3	0.20	Cooperation
4	0.20	Behavior

3.3. Assign a Match Rating

After setting all the criteria, the next step is to match the values of each alternative based on the criteria. From these employees the best employee will be selected, alternative data can be seen in table 5 below:

Table 5. Match Rating Value

Alternative	Criteria			
	C1	C2	C3	C4
A1	high	high	high	Very High
A2	Very High	high	high	Very High
A3	high	Very High	Very High	high
A4	Very High	high	high	high
A5	Very High	Very High	high	Very High
A6	Very High	high	Very High	high

The decision matrix x is formed from the table above and then converted into fuzzy numbers in Table 6 below.

Table6. Alternative Match Rating on Criteria

Alternative	**Criteria**			
	C1	C2	C3	C4
A1	4	4	4	5
A2	5	4	4	5
A3	4	5	5	4
A4	5	4	4	4
A5	5	5	4	5
A6	5	4	5	4

3.4. Matrix Normalization

The purpose of using the data in table 6 in the matrix normalization process is to obtain calculation results for each criterion. Meanwhile, Table 7 below shows the results of calculations for each criterion.

Table7. Normalized Matrix

Alternative	**Criteria**			
	C1	C2	C3	C4
A1	0.80	0.80	0.80	1.0
A2	1.0	0.80	0.80	1.0
A3	0.80	1.0	1.0	0.80
A4	1.0	0.80	0.80	0.80
A5	1.0	1.0	0.80	1.0
A6	1.0	0.80	1.0	0.80

3.5. Ranking of Alternative Recommendation Result

After normalizing the matrix, the next step is to multiply each normalized value with the appropriate criterion weight. Then, the results are summed and ranked. The alternative with the highest value is considered the best recommendation in decision making. The importance level of each criterion is used as the basis for giving weight by management.

$$W = 0.35; 0.25; 0.20; 0.20$$

Next, calculations are carried out using Equation 2 and adding up the multiplication results to get the best alternative recommendation.

$$V1 = (0.35\ x\ 0.80) + (0.35\ x\ 0.80) + (0.35\ x\ 0.80) + (0.35\ x\ 1.0) = 1.19$$
$$V2 = (0.35\ x\ 1.0) + (0.35\ x\ 0.80) + (0.35\ x\ 0.80) + (0.35\ x\ 1.0) = 1.26$$
$$V3 = (0.35\ x\ 0.80) + (0.35\ x\ 1.0) + (0.35\ x\ 1.0) + (0.35\ x\ 0.80) = 1.26$$
$$V4 = (0.35\ x\ 1.0) + (0.35\ x\ 0.80) + (0.35\ x\ 0.80) + (0.35\ x\ 0.80) = 1.19$$
$$V5 = (0.35\ x\ 1.0) + (0.35\ x\ 1.0) + (0.35\ x\ 0.80) + (0.35\ x\ 1.0) = 1.33$$
$$V6 = (0.35\ x\ 1.0) + (3.5\ x\ 0.80) + (0.35\ x\ 0.80) + (0.35x\ 1.0) = 1.26$$

Below is table 8 which displays the ranking calculation results of the alternatives that have been calculated previously. The alternative with the biggest V5 value is alternative A5, which can be considered as the best alternative. Based on the data in table 8, Abiyasa Alfarizi has the highest V5 score, so he can be recommended as the best employee at CV. Jaya Abadi.

Table8. Total Preference Value

Alternative	Criteria				The final result
	C1	C2	C3	C4	
A1	0.28	0.28	0.28	0.35	1.19
A2	0.35	0.28	0.28	0.35	1.26
A3	0.28	0.35	0.35	0.28	1.26
A4	0.35	0.28	0.28	0.28	1.19
A5	0.35	0.35	0.28	0.35	1.33
A6	0.35	0.28	0.28	0.28	1.26

4. Conclusion

The SAW method can be used in a decision support system to select the best employees at CV. Jaya Abadi. Criteria and sub-criteria data in this study are dynamic and can be changed according to the needs of decision makers. Service orientation criteria have the biggest contribution in determining the best employee. Abiyasa Alfarizi was chosen as the best employee with a total score of 1.33. The SAW method is effective and practical in determining the best employee recommendations so that decision makers can consider these recommendations with a predetermined priority.

References

[1] O. Rizan, C. Kirana, Hamidah, Hengki, H. A. Pradana, and A. Pangestu, "Determination of the Best Employees to Improve Service Quality using the SAW Algorithm," 2021, doi: 10.1109/ICORIS52787.2021.9649524.

[2] L. Karlitasari, D. Suhartini, and Benny, "Comparison of simple additive weighting (SAW) and composite performance index (CPI) methods in employee remuneration determination," in *IOP Conference Series: Materials Science and Engineering*, 2017, vol. 166, no. 1, doi: 10.1088/1757-899X/166/1/012020.

[3] E. Simanjuntak and B. Sinaga, "Decision Support System for Determining the Best Hospital Nurses Grandmed Method Using Simple Additive Weighting (SAW)," *J. Comput. Networks, Archit. High Perform. Comput.*, vol. 2, no. 1, 2020, doi: 10.47709/cnapc.v2i1.357.

[4] M. Hasanudin, Y. Marli, and B. Hendriawan, "Sistem Pendukung Keputusan Pemilihan Karyawan Terbaik Menggunakan Metode Analytical Hierarchy Process (Studi Kasus Pada Pt . Bando Indonesia)," *Semin. Nas. Teknol. Inf. dan Multimed. 2018*, vol. 6, no. 3, 2018.

[5] B. Setiadji and S. Sofiana, "Sistem Rekomendasi Pemilihan Karyawan Terbaik Dengan Metode TOPSIS Pada Bussan Auto Finance," *J. Inform. Univ. Pamulang*, vol. 1, no. 1, 2016.

[6] M. A. Budhi and R. Wardoyo, "Group Decision Support System Determination Of Best Employee Using Topsis And Borda," *IJCCS (Indonesian J. Comput. Cybern. Syst.*, vol. 11, no. 2, 2017, doi: 10.22146/ijccs.22773.

[7] Painem and H. Soetanto, "Decision support system with simple additive weighting for recommending best employee," 2019, doi: 10.23919/EECSI48112.2019.8977031.

[8] C. Kustandi, A. Reni, Hariyadi, T. Suharto, and N. Lestari, "Providing best employee rewards using decision support system method," *Int. J. Adv. Sci. Technol.*, vol. 29, no. 3, 2020.

[9] Z. Jabrayilova, “The principles of developing a management decision support system for scientific employees,” *EUREKA, Phys. Eng.*, vol. 2019, no. 4, 2019, doi: 10.21303/2461-4262.2019.00951.

[10] D. Kurniawati, D. Kusumawati, and M. Arifah, “Developing a Decision Support System with Dynamic Criteria for The Best Employee Assessment,” *J. Int. Conf. Proc.*, vol. 2, no. 2, 2019, doi: 10.32535/jicp.v2i2.603.

[11] H. Kusumo, “SISTEM PENDUKUNG KEPUTUSAN PEMILIHAN SISWA BERPRESTASI SEBAGAI PESERTA OLIMPIADE SAINS MENGGUNAKAN METODE SIMPLE ADDITIVE WEIGHTING (SAW),” *J. Teknol. Inf. DAN Komun.*, vol. 9, no. 2, 2020, doi: 10.51903/jtikp.v9i2.157.

[12] B. Efiriyanto, “Sistem Pendukung Keputusan Menggunakan Metode Simple Additive Weighting (SAW) Untuk Menentukan Karyawan Terbaik Pada Dealer Motor Berbasis Web,” *Skripsi Fak. Komun. dan Inform. UMS*, 2016.

[13] M. Marbun, M. Zarlis, and Z. Nasution, “Analysis of Application of the SAW, WP and TOPSIS Methods in Decision Support System Determining Scholarship Recipients at University,” in *Journal of Physics: Conference Series*, 2021, vol. 1830, no. 1, doi: 10.1088/1742-6596/1830/1/012018.

[14] R. Taufiq, R. S. Septarini, A. Hambali, and Y. Yulianti, “Analysis and Design of Decision Support System for Employee Performance Appraisal with Simple Additive Weighting (SAW) Method,” *J. Inform. Univ. Pamulang*, vol. 5, no. 3, 2020, doi: 10.32493/informatika.v5i3.6777.

[15] E. Putra, “Decision support system election of the best employees AT PT. Sukma Jaya Mandiri with Analytical Hierarchy Process (AHP) and Simple Additive Weighting (SAW) method,” *J. Adv. Res. Dyn. Control Syst.*, vol. 9, no. 16, 2017.