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Developing a Decision Support System with Dynamic Criteria for The Best Employee Assessment

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ABSTRACT

One of the efforts of the organizations management to foster the morale of human resources (HR) is to reward the best performing HR. HR with the best performance is assessed by various criteria determined by the organization. The problem is, how can a large organization that has many branches and / or organizational fields be able to select HR with the best performance objectively; while each branch or field of organization can have different emphases or interests in each HR assessment criteria. This research develops a decision support system that can be used to select the best HR with dynamic criteria and weighting. Criteria can be added or reduced, also the weight of the criteria can be adjusted to the system user. Decision support system was developed using the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) method. With TOPSIS it is possible to enter criteria that are expected to be positive and criteria that are expected to be negative. The results of the research conducted are a decision support system for determining the best employees with a dynamic and flexible multi model, where the criteria and weighting can be adjusted to the needs of the branch office or each part.

Keywords: best human resource, TOPSIS method, dynamic criteria

INTRODUCTION

Human Resources (HRs) as one of the most valuable assets of any organizations play a crucial role in their success (Wiem Zaouga, et al, 2019). With the integration of thinking skills plus the knowledge and experience possessed, an employee can make the best contribution to the progress of the organization.

Employees' development involves ensuring that employees are compensated fairly (Bolanle D. Motilewa, 2018). The rewards given to employees who have performed well cannot be compared to employees who are performing poorly. For this reason, the organization's efforts to find out the best employees they have need to be done well. The title as the best employee is both an award and encouragement for employees to do the best that can be done for the organization.

The best employee selection is done using many criteria determined by the organization. The number of criteria that must be assessed for the large number of employees is a separate problem if the best employee selection is done manually. Moreover, for organizations that have many branches and departments. Using a decision support system with information system technology is a good alternative.

Decision support system is a support tool that is able to process data based on a particular model, so users can choose the best alternative. Decision support systems can determine choices automatically (Prayitno E., 2016). With the best employee decision support system can be determined easily after knowing the criteria that underlie the provisions of the best employee selection. One method of decision support is Technique for Order Preference by Similarity to Ideal Solution (TOPSIS).

The TOPSIS method was postulated by Yoon (1980) and was further developed by Hwang and Yoon (1981) (Srikrishna et al., 2014). The technique is well-known in various Multi-Criteria Decision-Making (MCDM) methods (Bid S. and Siddique G., 2019) and is commonly used to assess prioritization of risk alternatives through weightage system among a set of risk alternatives (Lai et al., 1994; Dong et al., 2010; Yari and Chaji, 2012; Baecher, 2016; Yang and Nataliani, 2017).

This research will develop a decision support system to select the best employees with dynamic criteria in a supermarket that has many branches and departments using the TOPSIS method.

METHOD

System Analysis

The system built is a decision support system for selecting the best employees in supermarkets which have 3 branches, each of which has 8 equal parts. The 8 supermarket sections are Supermarkets, Home Appliances, Cosmetics, Food, Stationery, Warehouses, Fashion, and Cashiers. Each section has the same superior employee. Employee assessment is carried out using several criteria, namely Honesty, Rules, Absence, Discipline, Responsibility, Cleanliness, Crafts, Creativity, Cooperation, and Smiles.

The developed system will be used by several parties, namely managers, HRD, coordinators, and employees. To support the operation of this system, we need some data, namely part data, store data, employee data, employee data, criteria improvement data, and numeric data.

Decision-Making

The system has the ability to help decision-making determine the best employee in 10 categories, as shown in Table 1. The best employee selection categories include branch, department, and employee group coverage. The employee group consists of supervisors and employees. The best employees are chosen for the entire branch, so decision making is done at the central level; or the best employee for the branch office.

Table 1. The Best Employee Category

No	Category	Branch(es)	Department(s)	Employee Group	Chosen (person(s))
1	Category 1	All	All	All Groups	1
2	Category 2	All	All	Each Group	2
3	Category 3	All	All	Supervisor	1
4	Category 4	All	Each	All Groups	8
5	Category 5	All	Each	Each Group	16
6	Category 6	All	Each	Supervisor	8
7	Category 7	Each	All	All Groups	3
8	Category 8	Each	All	Each Group	6
9	Category 9	Each	All	Supervisor	3
10	Category 10	Each	Each	All Groups	24

Best employees can also be selected for the entire department or to any existing department. Meanwhile, according to the employee group, the best employee selection can be for all groups of employees, only supervisors, or for each group of employees. This system will select 72 of the best employees from all available categories.

Criteria Weights

The weights used in each criterion per department can be shown in the following Table 2.

Table 2 Criteria Weights

No	Criteria	Weight per department	Rule

		a	b	c	d	e	f	g	h	
1	Honesty Regulatory	3	4	4	3	4	3	4	4	Benefit
2	Regulations	4	3	4	4	4	4	4	4	Benefit
3	Absent	4	4	4	4	4	5	5	3	Cost
4	Discipline	5	5	5	5	5	5	5	5	Benefit
5	Responsible	5	5	5	5	5	5	5	5	Benefit
6	Cleanliness	4	4	4	4	4	4	4	4	Benefit
7	Craft	4	4	4	4	4	4	4	4	Benefit
8	Creativity	4	4	4	3	4	4	3	4	Benefit
9	Cooperation	3	3	4	4	4	4	4	3	Benefit
10	Smile	4	4	4	4	4	4	4	4	Benefit

a: Supermarket, b: Household Appliances, c: Cosmetics, d: Food, e: Stationary, f: Warehouse, g: Fashion, h: Cashier

The weights used in this system are in the form of numbers 1 to 10. In the best employee selection system in supermarkets the weights used may differ in each department and in every groups. The criteria and weights used in all branches are the same. The accumulated weights in percent are shown in Table 3. which will be used later in the weighted normalization calculation process by TOPSIS.

Table 3. Accumulated Weights

No	Criteria	Weight per department (%)							
		a	b	c	d	e	f	g	h
1	Honesty Regulatory	7.5	10	9.5	7.5	9.5	7.1	9.5	10
2	Regulations	10	7.5	9.5	10	9.5	9.5	9.5	10
3	Absent	10	10	9.5	10	9.5	11.9	11.9	7.5
4	Discipline	12.5	12.5	11.9	12.5	11.9	11.9	11.9	12.5
5	Responsible	12.5	12.5	11.9	12.5	11.9	11.9	11.9	12.5
6	Cleanliness	10	10	9.5	10	9.5	9.5	9.5	10
7	Craft	10	10	9.5	10	9.5	9.5	9.5	10
8	Creativity	10	10	9.5	7.5	9.5	9.5	7.1	10
9	Cooperation	7.5	7.5	9.5	10	9.5	9.5	9.5	7.5
10	Smile	10	10	9.5	10	9.5	9.5	9.5	10

Furthermore, the calculation to determine the best employee is done using the stages that exist in the TOPSIS method as shown in Fig 1 below.

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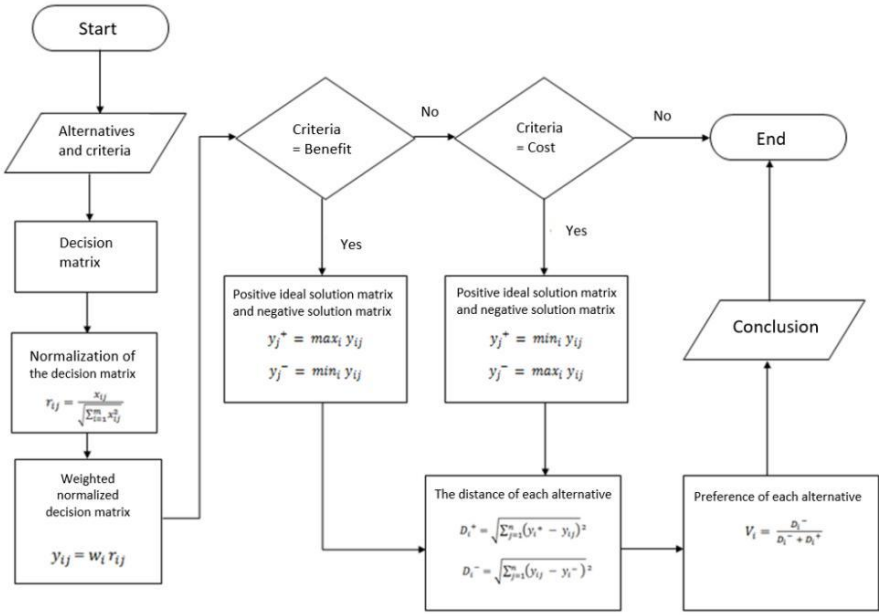

Fig 1. Flowchart of the calculation process

TOPSIS requires a performance rating for each alternative Ai for each criterion Cj which is normalized, by using the formula

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^2}} \text{ ; with i = 1, 2, …, m; and j = 1, 2, …, n} \quad (1)$$

Where, r_{ij} is an element of the normalized decision matrix R, and x_{ij} as an element of the X matrix. Positive ideal solution A^+ dan negative ideal solution A^- can be determined based on a normalized weight rating ( ). by using the formula $y_{ij} = w_i\, r_{ij}$

Where y_{ij} is normalized weighted matrix of i^{th} alternative and j^{th} criteria; w_i is i^{th} alternative weights; r_{ij} is element of the normalized decision matrix R.

Positive ideal solution A^+ and negative ideal solution A^- can be calculated using equations

$$A^+ = (y_1^+, y_2^+, \dots y_n^+) \quad (2)$$

$$A^- = (y_1^-, y_2^-, \dots y_n^-) \quad (3)$$

Where,

$$y_j^+ = \begin{cases} \max_i y_{ij} \text{ ; if j is the benefit atribute} \\ \min_i y_{ij} \text{ ; if j is the cost atribute} \end{cases}$$

$$y_j^- = \begin{cases} \min_i y_{ij} \text{ ; if j is the benefit atribute} \\ \max_i y_{ij} \text{ ; if j is the cost atribute} \end{cases}$$

Distance between alternatives A^- positive ideal solution and negative ideal solution can be calculated using equations

$$D_i^+ = \sqrt{\sum (y_j - y_j^+)^2} \quad (4)$$

$$=1$$

$$^{-}=\sqrt{\sum} \quad (\ -\ ^{-})^{2} \qquad (5)$$

Where D^{+} is distance positive ideal solution and D^{-} is the negative ideal solution.

The preference value of each alternative which is greater indicates that alternative Ai is preferred over other alternatives, using the formula

$$= \qquad (6)$$

Where is the preference value of i^{th} alternative?

RESULT AND DISCUSSION

From the data obtained in the last 1 year in 3 branches for all employees in all departments, obtained the value of the positive ideal solution A^{+} as shown in Table 4. The numbers in Table 4 were obtained using equation (2). The value of a positive ideal solution indicates the sum of all the best values that can be achieved for each attribute. In this step, careful attention must be paid to whether a criterion is included in the profit or cost variable because the search for an ideal solution, both positive and negative, depends on the type of variable used.

Table 4. The Value of The Positive Ideal Solution

Branch	Criteria	A^{+}							
		a	b	c	d	e	f	g	h
1	K1	3.87	5.02	4.66	3.86	4.63	3.43	4.63	5.04
	K2	4.89	3.61	4.54	4.86	4.59	4.63	4.63	4.70
	K3	2.29	2.29	2.18	1.92	2.18	2.73	2.73	1.72
	K4	6.16	6.16	6.16	6.47	5.86	5.64	5.86	6.15
	K5	6.08	6.02	5.83	6.23	5.78	5.78	5.78	5.87
	K6	5.11	5.25	4.87	5.09	4.68	4.63	4.62	4.98
	K7	5.02	4.86	4.57	4.86	4.69	4.63	4.63	4.86
	K8	4.86	5.05	4.86	3.83	4.76	4.47	3.47	4.71
	K9	4.10	3.51	4.71	4.71	4.57	4.57	4.25	3.67
	K10	5.10	4.98	4.86	4.97	4.65	4.63	4.63	5.10
2	K1	3.66	4.68	4.68	3.51	4.46	3.30	4.68	4.91
	K2	5.11	3.80	4.83	5.07	4.83	4.57	4.57	5.07
	K3	2.13	4.47	4.25	2.67	4.25	5.32	2.29	3.35
	K4	6.07	6.00	5.78	6.07	5.72	5.72	5.78	6.07
	K5	6.07	6.00	5.66	6.09	5.72	5.72	5.78	5.94
	K6	5.11	4.91	4.68	4.91	4.68	4.79	4.68	4.91
	K7	5.01	4.87	4.77	4.87	4.64	4.64	4.77	5.01
	K8	4.90	4.68	4.46	3.51	4.46	4.79	3.34	4.68
	K9	4.10	4.00	5.20	5.46	5.08	5.08	5.20	4.10
	K10	4.80	4.80	4.57	4.80	4.57	4.64	4.57	4.80

Table 4 (continued)

3	K1	3.57	4.68	4.59	3.35	4.46	3.19	4.68	4.91
	K2	4.65	3.51	4.83	5.07	4.75	4.57	4.57	4.79
	K3	2.29	4.47	2.38	2.29	2.18	5.32	4.76	3.35
	K4	6.07	6.00	5.78	6.07	5.59	5.72	5.71	6.07
	K5	6.24	5.59	5.32	6.09	5.72	5.31	5.78	5.87
	K6	4.96	4.91	4.68	4.91	4.68	4.79	4.63	4.91

	K7	5.01	4.87	4.77	4.87	4.47	4.64	4.77	5.01
	K8	4.90	4.68	4.46	3.51	4.46	4.85	3.34	4.68
	K9	3.64	3.35	4.93	5.02	4.85	5.08	4.45	3.61
	K10	4.58	4.80	4.46	4.80	4.57	4.64	4.60	4.86
	K1	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95
	K2	2.18	2.18	2.18	2.18	2.18	2.18	2.18	2.18
	K3	1.79	1.79	1.79	1.79	1.79	1.79	1.79	1.79
	K4	3.28	3.28	3.28	3.28	3.28	3.28	3.28	3.28
All	K5	3.37	3.37	3.37	3.37	3.37	3.37	3.37	3.37
Branches	K6	2.73	2.73	2.73	2.73	2.73	2.73	2.73	2.73
	K7	2.78	2.78	2.78	2.78	2.78	2.78	2.78	2.78
	K8	2.77	2.77	2.77	2.77	2.77	2.77	2.77	2.77
	K9	2.82	2.82	2.82	2.82	2.82	2.82	2.82	2.82
	K10	2.78	2.78	2.78	2.78	2.78	2.78	2.78	2.78

Similarly, the positive ideal solution value, the value of the negative ideal solution comprised of all the worst value achieved for each attribute. The value of the negative ideal solution is obtained using equation (3).

Table 5. The Value of The Negative Ideal Solution

Branch	Criteria	A^-							
		a	b	c	d	e	f	g	h
	K1	2.50	4.08	4.07	2.89	3.81	3.02	3.81	3.85
	K2	3.97	2.93	3.96	4.00	3.78	3.81	3.81	4.11
	K3	6.88	6.88	6.55	5.77	6.55	8.19	8.19	5.16
	K4	5.07	5.07	4.34	4.56	4.82	4.64	4.82	5.07
	K5	5.00	4.89	5.09	5.13	4.76	4.76	4.76	5.14
1									
	K6	3.90	3.79	3.72	3.59	3.86	3.81	3.80	4.10
	K7	3.76	4.00	3.76	4.00	3.73	3.81	3.81	4.00
	K8	4.00	3.85	3.43	2.70	3.70	3.91	2.86	4.08
	K9	2.41	3.09	3.32	3.32	3.76	3.76	4.25	2.80
	K10	3.60	3.81	3.71	3.50	3.78	3.81	3.81	3.60
	K1	2.97	4.13	3.74	3.10	3.91	3.11	3.74	3.93
	K2	3.91	2.68	3.41	3.58	3.41	4.03	3.76	3.58
	K3	6.39	4.47	4.25	5.34	4.25	5.32	6.87	3.35
	K4	5.00	5.30	4.76	4.00	5.04	5.04	4.76	5.00
	K5	5.00	5.30	4.60	4.57	5.04	5.04	4.76	4.83
2									
	K6	3.90	3.76	3.58	3.76	3.58	3.58	3.58	3.76
	K7	3.76	3.65	3.58	3.66	3.48	3.48	3.58	3.76
	K8	3.45	4.13	3.93	3.10	3.93	3.93	2.95	4.13
	K9	2.41	2.35	3.06	3.21	2.99	2.99	3.06	2.41
	K10	4.24	4.24	4.03	4.20	4.03	4.03	4.03	4.24
	K1	3.12	4.13	4.02	3.35	3.93	3.19	3.74	3.93
	K2	4.03	3.10	3.41	3.58	3.56	4.03	3.76	3.95
	K3	6.88	4.47	7.14	6.88	6.55	5.32	7.14	3.35
	K4	5.00	5.30	4.76	5.00	4.89	5.04	4.70	5.00
	K5	4.96	5.59	5.32	4.57	5.04	5.32	4.76	5.14
3									
	K6	4.08	3.76	3.58	3.76	3.58	3.38	3.81	3.76
	K7	3.76	3.65	3.58	3.65	3.91	3.48	3.58	3.76
	K8	3.45	4.13	3.93	3.10	3.93	3.43	2.95	4.13
	K9	3.00	3.35	2.90	3.54	3.43	2.99	3.67	2.93
	K10	4.29	4.24	3.93	4.24	4.03	3.48	4.05	4.29

Table 5 (continued)

All Branches	K1	1.72	1.72	1.72	1.72	1.72	1.72	1.72	1.72
	K2	2.18	2.18	2.18	2.18	2.18	2.18	2.18	2.18
	K3	5.38	5.38	5.38	5.38	5.38	5.38	5.38	5.38
	K4	2.70	2.70	2.70	2.70	2.70	2.70	2.70	2.70
	K5	2.77	2.77	2.77	2.77	2.77	2.77	2.77	2.77
	K6	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93
	K7	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96
	K8	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95
	K9	1.66	1.66	1.66	1.66	1.66	1.66	1.66	1.66
	K10	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96

The trial was conducted using the data in Table 6 which is the employee data of the warehouse section from 3 branches. From each branch was represented by 5 employees. Assessment is carried out by supervisors per department in each branch which is conducted every month.

Table 6. Test Data

Branch	Employee	Criteria									
		a	b	c	d	e	f	g	h	i	j
1	Employee1_1	80	80	1	85	75	70	75	80	75	80
	Employee1_2	75	85	2	70	80	80	80	75	85	85
	Employee1_3	85	70	1	80	85	75	85	75	80	70
	Employee1_4	75	75	3	85	70	85	70	80	85	75
	Employee1_5	80	80	2	80	80	80	80	70	70	80
2	Employee2_1	80	75	2	75	75	60	75	60	75	75
	Employee2_2	80	80	2	80	80	70	80	70	80	80
	Employee2_3	85	75	2	85	75	80	60	80	85	60
	Employee2_4	80	80	2	75	80	80	70	80	60	70
	Employee2_5	85	85	2	80	85	85	80	85	50	80
3	Employee3_1	80	75	1	75	75	60	75	60	75	75
	Employee3_2	80	80	1	80	75	70	80	70	80	80
	Employee3_3	80	75	1	85	75	80	60	75	85	60
	Employee3_4	80	80	1	75	75	80	70	80	60	70
	Employee3_5	80	85	1	80	75	85	80	85	50	80

a: Honesty, b: Regulatory Regulations, c: Absent, d: Discipline, e: Responsible,
f: Cleanliness, g: Craft, h: Creativity, i: Cooperation, j: Smile

By using employee data in table 6 and equation (3), the values of D^+ and D^- and V can be seen in Table 7. The TOPSIS method considers the distance to the positive ideal solution and the negative ideal solution by taking the value of proximity relative to the positive solution.

Table 7 shows the distance between the value of each alternative, in this case the employee, with the value of the positive ideal solution (D^+) and the distance between the value of each alternative and the value of the negative ideal solution (D^-). Preferred value of each alternative is calculated using equation
(6).

Table 7. Weighted Alternative Distances and Preference Values

Store	Employee	Branch				All			
		D^+	D^-	V	Rank	D^+	D^-	V	Rank
1	Employee1_1	1.38	5.66	0.80	2	0.83	3.90	0.82	1
	Employee1_2	2.99	3.25	0.52	3	1.95	2.58	0.57	8
	Employee1_3	1.37	1.66	0.80	1	0.85	3.96	0.82	2
	Employee1_4	5.68	1.66	0.22	5	3.71	1.77	0.32	15
	Employee1_5	2.99	3.09	0.50	4	1.97	1.33	0.54	10
2	Employee2_1	2.39	1.93	0.44	5	2.29	2.12	0.48	14
	Employee2_2	1.36	2.61	0,65	1	1.97	2.38	0.54	9
	Employee2_3	1.89	2.72	0.58	2	2.20	2.42	0.52	12
	Employee2_4	1.93	1.93	0.50	4	2.16	2.16	0.50	13
	Employee2_5	2.12	2.12	0.56	3	2.16	2.48	0.53	11
Table 7 (continued)									
3	Employee3_1	2.30	1.93	0.45	5	1.43	3.76	0.72	7
	Employee3_2	1.31	2.59	0.66	1	0.88	3.90	0.81	3
	Employee3_3	1.84	2.61	0.58	2	1.32	3.91	0.74	6
	Employee3_4	1.89	1.91	0.50	4	1.25	3.77	0.75	5
	Employee3_5	2.12	2.66	0.55	3	1.27	3.93	0.75	4

From Table 7, it can be seen the ranking of each employee in each branch and ranking in general. For the calculation of D^+ and D^- each branch, the data used is only branch data, whereas for the whole data will be used as a whole. This can be seen from the difference in the values of D^+ and D^- between branches and overall for the same alternative.

From Table 7 shows a very significant difference between assessments by comparing alternatives per branch by comparing alternative assessments in all branches. The difference in the value of V for each alternative produced depends on the value of D^+ for each alternative. If the value of D^+ gets higher than the value of V will be lower and applies vice versa, so that it will result in the results of the value of V and ranking be different.

CONCLUSION

Using the TOPSIS method with dynamic criteria can determine the best employees of an organization with many branches, sections and groups of employees. The calculation results are strongly influenced by the closest distance between the values of each alterative per criterion with the positive optimal value desired in each criterion.

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