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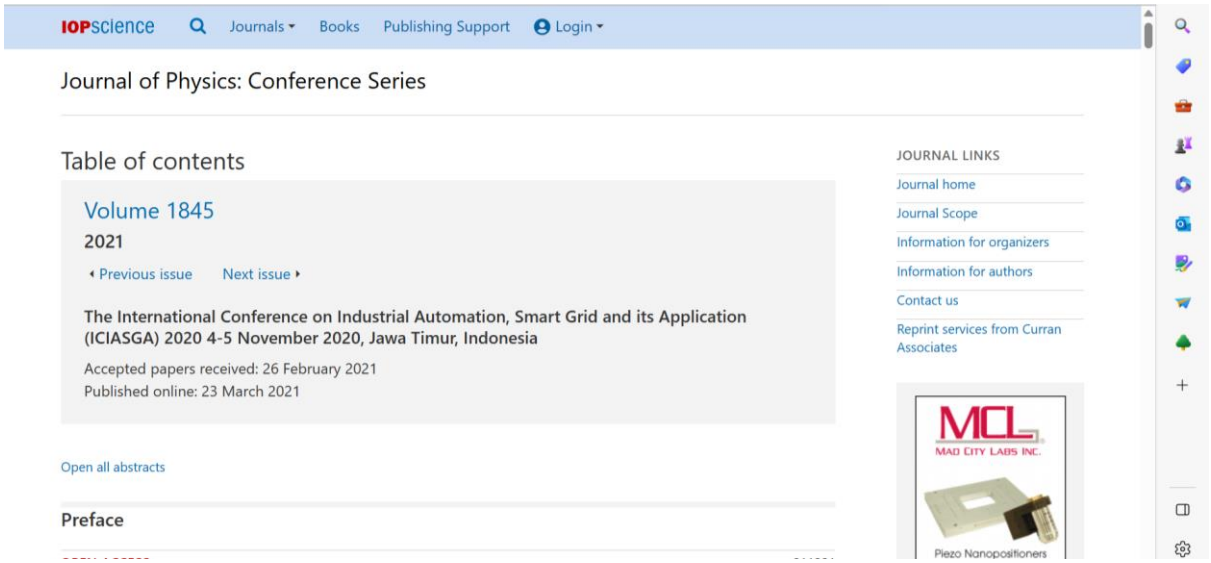

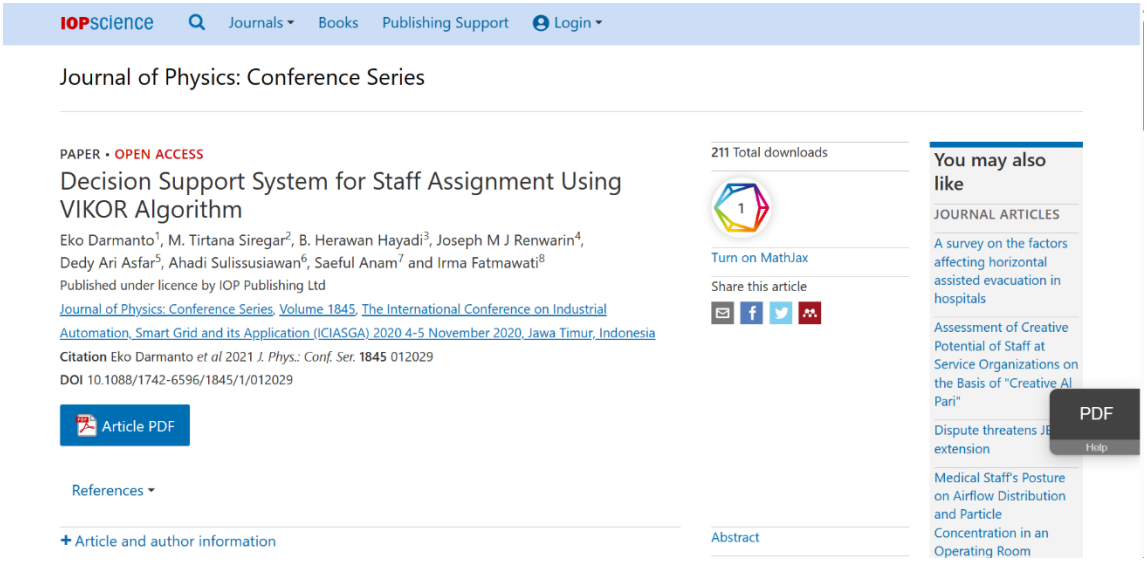

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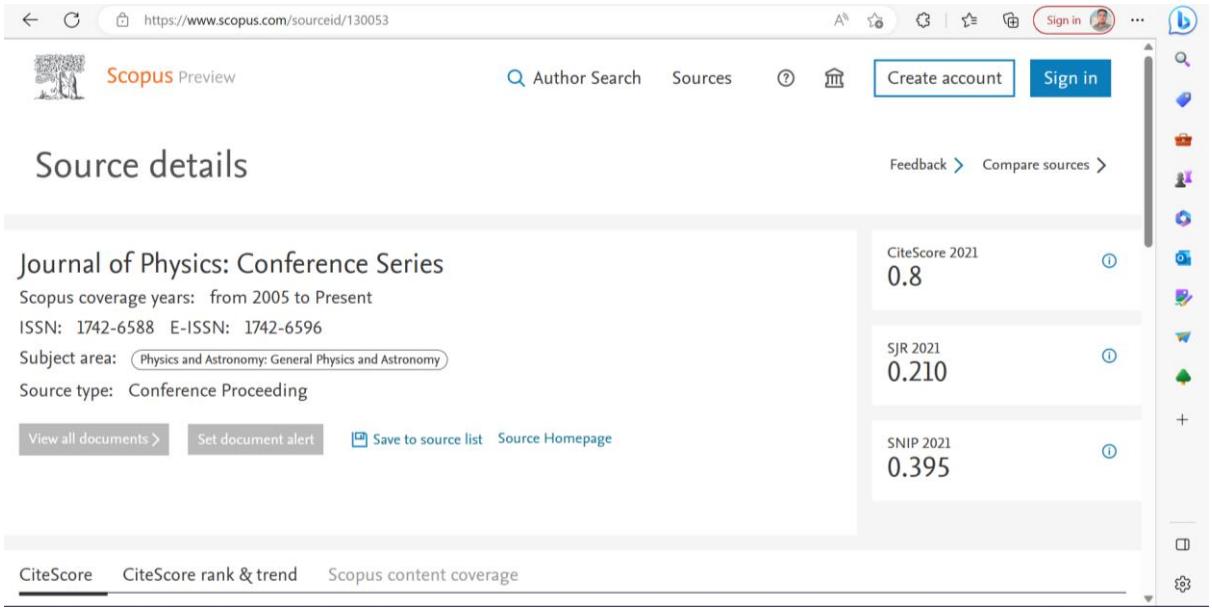

Decision Support System for Staff Assignment Using VIKOR Algorithm

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Abstract. Call center staff is a staff who work in providing repair or servicing services by telephone. This staff is in charge of explaining the solutions to be carried out by the company in obtaining answers. Call center staff must have a good temperament and smart. In getting good staff, companies can use a decision support system with the VIKOR method to select and select these staff. Five criteria will be tested in determining the staff. The results of the VIKOR method can help companies find call center staff that match company expectations. The ranking results can determine the level of results of the VIKOR method test on call center staff who are used as candidates or alternatives. By implementing this method, the search for call center staff will be better.

1. Introduction

In this sophisticated era, many tools or facilities can help humans carry out their daily activities. These facilities can be in the form of electronic devices, food, and various other services. Each facility can be obtained easily by looking at references on the internet or going directly to the facility's point of sale. However, sometimes, someone must have experienced problems or obstacles in using or enjoying the facilities that have been purchased or obtained [1].

In solving the problems faced, each company providing the facility must be responsible for providing aftersales service. This service is a service for complaints about problems faced by customers. But in reality, buyers find it difficult to contact the store that has sold the item again. Services by telephone or voice are needed in providing solutions to customers.

The call center is one of the places where customers can contact those on duty to help solve their problems. But not all call center staff can provide information or solutions well. Some are still inaccurate

in providing solutions, and some have less patience so that customers feel dissatisfied with the solutions that have been given. It occurs due to the lack of selectivity in selecting call center staff.

This study examines how to determine call center staff with the help of a decision support system. The VIšekriterijumsko KOmpromisno Rangiranje (VIKOR) method is the method used in this study. The VIKOR method is a Multi-Criteria Decision Making (MCDM) method that can be used to select more than one criterion. The VIKOR method works by calculating the value of utility measures and regret measures in determining which prospective staff will be selected for a call center position.

2. Theories

2.1 Call Center

Call Center is centralized technical support to receive or send a large number of inquiries over the telephone. A company operates an incoming call center to manage the incoming product or support services or inquiries from consumers. Outgoing call centers are operated for telemarketing, soliciting charitable or political donations, debt collection, market research, emergency notices, and urgent/critical blood banking needs. A further extension to the call center manages the centralized handling of personal communications, including mail, fax, direct support software, social media, instant messaging, and email [2].

A call center has staff called agents. It includes computers and displays for each agent connected to an incoming/outgoing call management system and one or more control stations. It can be operated independently or connected to additional centers, often linked to a corporate computer network, including mainframes, microcomputers/servers, and LANs. Voice and data lines to the center are increasingly connected via a new set of computer-telephony integration technologies.
The contact center is the central point from which all customer contacts are managed. Through the contact center, valuable information about the company is passed on to the right people, contacts to track, and data to collect. It is generally part of the company's customer relationship management infrastructure. The majority of large companies use contact centers as a means of managing their customer interactions. These centers can be operated by an internal department in charge of or outsource customer interactions to third party agents (known as Outsourcing Call Centers).

2.2 VIKOR

Yu and Zeleny introduced the idea of compromising ranking. Then, Opricovic and Tzeng introduced the VIKOR method as a compromise ranking method [3]. A compromise solution is a viable solution closest to the ideal solution, whereas compromise means an agreement made with mutual consent. VIšekriterijumsko KOmpromisno Rangiranje (VIKOR) is one of the methods used in Multi-Attribute Decision Making (MADM) closest answer approach to the ideal solution in the ranking. This method focuses on ranking and selecting from several alternatives even though the criteria are conflicting. The problem of selecting scholarship recipients is a problem that can be solved with the MADM technique using the VIKOR method. The VIKOR method provides a ranking to the closest solution even though there are conflicting criteria. Decision makers, in this case, the student affairs department, can choose the right ranking according to the available alternatives [4].

The VIKOR method consists of five steps, such as:

1. Arrange the criteria and alternatives into a matrix.
   In this step, each criterion and alternative are arranged into a matrix form F, Ai states that i_{th} alternative i = 1,2,3, n; C_{xn} specifies the criteria j_{th} j = 1,2,3, m.

$$F = \begin{matrix} \\ A_1 \\ A_2 \\ \vdots \\ A_m \end{matrix} \begin{bmatrix} C_{x1} & C_{x2} & \cdots & C_{xn} \\ x_{11} & x_{12} & \cdots & x_{1n} \\ x_{21} & x_{22} & \cdots & x_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ x_{m1} & x_{m2} & \ldots & x_{mn} \end{bmatrix}$$

Then the matrix is normalized by the following equation:

$$\mathbf{f_{ij}} = \frac{\mathbf{x_{ij}}}{\sqrt{\sqrt{\sum_{i=1}^{m} \mathbf{x_{ij}}^2}}}, \mathbf{i = 1, 2, \ldots, m}$$

x_{ij} is the value of the alternative A_i against the criterion j_{th}.

2. Determine a positive or negative value as the ideal solution for each criterion. In this step, the alternatives are determined as positive **Ai** $*$ or negative **Ai** -. Positive **Ai** $*$ is the highest value of a criterion. It is the best, **Ai** $*$ = **maxjAij**. While negative **Ai** - that is, the smallest value of the criteria is the best, **Ai** - = **minjAij**. So that it can be written with the following equation:

$$\mathbf{A}^* = \{\mathbf{f}^*_1, \mathbf{f}^*_2, \ldots, \mathbf{f}^*_n\}$$
$$\mathbf{A}^- = \{\mathbf{f}_1, \mathbf{f}_2, \ldots, \mathbf{f}_n\}$$

3. Calculates utility measures. Utility measures of each alternative are calculated using the following formula:

$$\mathbf{S_i} = \sum_{j=1}^{n} \mathbf{w_j} \frac{(\mathbf{f_j^* - f_{ij}})}{(\mathbf{f_j^* - f_j^-})}$$
$$\mathbf{R_i} = \mathbf{Max_j} \left[\mathbf{w_j} \frac{(\mathbf{f_j^* - f_{ij}})}{(\mathbf{f_j^* - f_j^-})} \right]$$

S_i (maximum group utility) and R_i (minimum individual regret of the opponent), both state utility measures measured from the farthest and closest points of the ideal solution, while w_j is the weight given to each criterion j_{th}.

4. Calculating the VIKOR index. Each i_{th} alternative is calculated for its VIKOR index using the following formula:

$$\mathbf{Q_i} = \mathbf{v} \left[\frac{\mathbf{S_i - S^*}}{\mathbf{S^- - S^*}} \right] + (\mathbf{1 - v}) \left[\frac{\mathbf{R_i - R^*}}{\mathbf{R^- - R^*}} \right]$$

S * = Min_i (S_i), S- = Max_i (S_i), R * = Min_i (R), R- = Max_i (R); and v are weights ranging from 0-1 (generally 0.5). The smaller the VIKOR (Q_i) index value, the better the solution for those alternatives.

5. Alternative ranking. After Q*i* is calculated, there will be 3 kinds of rankings, such as S_i, R_i and Q_i. A compromise solution is seen in ranking Q_i. Alternative rankings can be checked using the following conditions:

Condition 1: Accepted if **Q** (***A2***) - **Q** (***A1***) ≥ **DQ** with **DQ** = **1** / (***n*** − **1**). ***A1*** is the first alternative in the Qi ranking, A2 is the second alternative in the Qi ranking.
Condition 2: Accepted by looking at the stability of the alternative ranking. The stability of the ranking alternatives was assessed when the value v> 0.5, or v ≈ 0.5, or v <0.5.

If one of the conditions is not satisfactory, then a compromise solution can be put forward by choosing alternatives A1 and A2 if only condition 2 is unsatisfactory, or Choosing alternatives A1, A2, ..., An if condition 1 is unsatisfactory. An is an alternative that is determined using an $\mathbf{Q}(\boldsymbol{An}) - \mathbf{Q}(\boldsymbol{A1}) < \mathbf{DQ}$, $\mathbf{DQ} = \mathbf{1}/(\mathbf{n}-\mathbf{1})$.

3. Methodology

3.1 Criteria Design

The criteria are determined based on observations. This study uses five criteria, which are described in the following tables.

Table 1. Verbal Ability

Verbal Abilities	Weight
Very good	90 – 100
Good	80 – 89
Enough	70 – 79
Less	60 – 69
Bad	50 – 59

Verbal ability criteria are criteria that assess a person's ability to carry out conversations and provide information.

Table 2. Voice Intonation

Voice Intonation	Weight
Very good	90 – 100
Good	80 – 89
Enough	70 – 79
Less	60 – 69
Bad	50 – 59

Voice intonation criteria are criteria that provide an assessment of a person's assertiveness in speaking. Assessment criteria include tone and style of speech.

Table 3. English Proficiency

English Proficiency	Weight
Very good	90 – 100
Good	80 – 89
Enough	70 – 79
Less	60 – 69

Bad	50 – 59

English proficiency criteria are very important in the reception of call center staff. English is required when service users are foreigners.

Table 4. Memorization Power

Memorization Power	Weight
Very good	90 – 100
Good	80 – 89
Enough	70 – 79
Less	60 – 69
Bad	50 – 59

A call center staff is important in providing information to customers. The information provided should be memorized by heart so that customer problem solving can be resolved quickly.

Table 5. Entrance Test Score

Entrance Test Score	Weight
Very good	90 – 100
Good	80 – 89
Enough	70 – 79
Less	60 – 69
Bad	50 – 59

The entrance test score is the entrance test score. It is a theoretical and practical assessment of getting a chance to become a call center staff.

4. Result and Discussion

In this section, the VIKOR method testing process will be carried out on some data. This study used a sample of 10 pieces of data with different criteria values from one another. Complete calculations can be seen in the following tables. As previously explained, the scholarship selection process uses the VIKOR method as a ranking method. Recipient selection for call center staff is a matter for MADM because it is in discrete space and focuses on selecting and sorting the right number of alternatives according to the criteria made. Criteria are the selection rules made by the author in making a selection. The VIKOR method is the MADM method, which has complex linear normalization calculations, which can compromise existing alternatives/solutions. This method was chosen because it provides the closest ranking to the ideal solution. The completion steps are as follows:

1. Determine alternative data (Table 6)
2. Determine the weight of preference and positive and negative values (Table 7)
3. Normalize the matrix and determine the weight of each criterion (Table 8)
4. Determine the weighted matrix (Table 9)

5. Utility measures and regret measures (Table 10)
6. Creating a ranking index for Si, Ri, and Qi (Table 11)
7. Rank Qi using different v (Table 12)

Table 6. Data Sample

		Verbal	Intonation	English	Memorization	Entrance Test
		Benefit	Benefit	Benefit	Benefit	Benefit
Index	Name	K1	K2	K4	K4	K5
A1	Staff 1	63	64	87	60	64
A2	Staff 2	98	95	61	73	88
A3	Staff 3	63	82	84	65	89
A4	Staff 4	90	76	91	60	79
A5	Staff 5	93	61	86	73	97
A6	Staff 6	81	75	97	89	74
A7	Staff 7	80	96	94	80	96
A8	Staff 8	92	76	95	85	87
A9	Staff 9	71	68	71	88	62
A10	Staff 10	74	100	87	68	68

The next step is to determine preference weights and positive and negative values of the criteria used. Table 7 describes the results of the two values.

Table 7. Preference Weights and Positive and Negative Values

W1	W2	W3	W4	W5	Total
5	3	4	4	4	20
0,25	0,15	0,2	0,2	0,2	1

F1+	F2+	F3+	F4+	F5+
98	100	97	89	97
F1-	**F2-**	**F3-**	**F4-**	**F5-**
63	61	61	60	62

After determining each criterion's preference weight, the next step is to multiply the alternative value by the preference weight along with the positive and negative values. The criterion that is sought with the highest score, the value becomes positive. While the criteria that are sought with the lowest measure, the value becomes negative. The highest and lowest scores for each criterion are determined to determine the difference between the highest and lowest scores. The next step is to normalize the matrix to look like Table 8 and assign weights to each criterion.

Table 8. Normalization

Index	Name	K1	K2	K4	K4	K5
A1	Staff 1	1,000	0,923	0,278	1,000	0,943

A2	Staff 2	0,000	0,128	1,000	0,552	0,257
A3	Staff 3	1,000	0,462	0,361	0,828	0,229
A4	Staff 4	0,229	0,615	0,167	1,000	0,514
A5	Staff 5	0,143	1,000	0,306	0,552	0,000
A6	Staff 6	0,486	0,641	0,000	0,000	0,657
A7	Staff 7	0,514	0,103	0,083	0,310	0,029
A8	Staff 8	0,171	0,615	0,056	0,138	0,286
A9	Staff 9	0,771	0,821	0,722	0,034	1,000
A10	Staff 10	0,686	0,000	0,278	0,724	0,829

Table 9. Weighted Matrix

Index	Name	K1	K2	K4	K4	K5
A1	Staff 1	0,250	0,138	0,056	0,200	0,189
A2	Staff 2	0,000	0,019	0,200	0,110	0,051
A3	Staff 3	0,250	0,069	0,072	0,166	0,046
A4	Staff 4	0,057	0,092	0,033	0,200	0,103
A5	Staff 5	0,036	0,150	0,061	0,110	0,000
A6	Staff 6	0,122	0,096	0,000	0,000	0,131
A7	Staff 7	0,129	0,015	0,017	0,062	0,006
A8	Staff 8	0,043	0,092	0,011	0,028	0,057
A9	Staff 9	0,193	0,123	0,144	0,007	0,200
A10	Staff 10	0,172	0,000	0,056	0,145	0,166

Table 10. Utility Measures and Regret Measures

Index	Name	S	R
A1	Staff 1	0,833	0,250
A2	Staff 2	0,380	0,200
A3	Staff 3	0,603	0,250
A4	Staff 4	0,485	0,200
A5	Staff 5	0,357	0,150
A6	Staff 6	0,349	0,131
A7	Staff 7	0,229	0,129
A8	Staff 8	0,231	0,092
A9	Staff 9	0,667	0,200
A10	Staff 10	0,539	0,172

Table 11. Ranking index for Si, Ri, and Qi

S+
0,833
S-
0,229
R+
0,250
R-
0,092

After getting Si, Ri, QS, and QR (compromise value), the next step is to calculate the VIKOR index (Qi) with equation (7) using the value v = 0.5. Thus, it will produce a ranking, as shown in Table 12. Rank

Si is a ranking based on the approach with the farthest solution point with the ideal solution, Ri ranking is a ranking based on the approach with the closest solution point to the ideal solution. At the same time, Qi rank is a compromise ranking by calculating the VIKOR index.

Table 12. Ranking Result

Index	Name	VIKOR
A8	Staff 8	0,002
A7	Staff 7	0,117
A6	Staff 6	0,223
A5	Staff 5	0,290
A2	Staff 2	0,467
A10	Staff 10	0,510
A4	Staff 4	0,554
A9	Staff 9	0,704
A3	Staff 3	0,810
A1	Staff 1	1,000

5. Conclusion

There are several conclusions obtained after conducting this research. The VIKOR method can determine which prospective employees are eligible to become call center staff. The criteria are obtained based on the observations made by the author. The preference weights are obtained based on comparing the criteria components used in the call center selection process. The value of utility measures and regret measures has a significant effect on the final ranking results. It is also determined by the value v = 0.5 in determining Q's value as the final result of ranking.

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