Decision Support System for Conflicting Criteria on The Best Performing Employees Selection Using VIKOR

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Decision Support System for Conflicting Criteria on The Best Performing Employees Selection Using VIKOR

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ABSTRACT : *Administrative Performance Assessment is always carried out every year at institution called Unisbank. This assessment aims to increase employee motivation to work better and be accomplished.The assessment criteria are based on attendance and tardiness, completion of services and complaints, work ability and willingness to work outside of their responsibilities, as well as employee commitments and violations.In determining the best performing employees, there are several conflicting criteria and decision makers must determine the ranking based on these criteria.*
Decision Support System is made by implementing the VIKOR method to solve the problem of selecting the best performing employee.The VIKOR method was developed for multi-criteria optimization of complex systems, solve decision problems with conflicting and noncommensurable criteria. This method is recommended for decision maker wants a solution that is the closest to the idea.
The research results can be used by decision makers in determining the best performing employees.The decision support system has employee input facilities as an alternative, manages criteria components and calculates ranking values for employees with the best performance.
KEYWORDS: *decision support system, dss, vikor, conflicting criteria, employees.*

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I. INTRODUCTION

Giving rewards to employees often occurs in an organization. It aims to provide an appreciation that can increase employee motivation to work better and be accomplished.As an organization, Unisbank always routinely gives awards to all its employees based on the Administrative Performance assessment.The assessment criteria in Administrative Performance are attendance, lateness, completion of services, complaints, work ability, willingness to work outside of their responsibilities, commitment in every institutional activity and employee violations.The ultimate goal of the assessment process is to select employees who have the best performance based on the criteria set by the institution.Employee evaluation and selection activities are carried out routinely, so a decision support system is needed that can simplify the employee selection process and store data on the results of the assessment.

Decision Support System (DSS) is one way that can be used to solve the problem of selecting employees with the best performance. DSS is a tool to support data analysis, decision modeling and future planning orientation. Decision Support System (DSS) is an information system that uses decision models, databases, manager thinking, interactive modeling processes with computers to achieve decision making. DSS can provide interactive tools that allow a decision maker to perform various analyzes of the available models.Zarini et. al. [1] developed a Decision Support Software (DSS) for matching tractor implement system used on Iranian farms. The purpose of this study was development software for mechanized operation and its application in paddy's farms. This software has databases including variety of tractor models and implements sizes.The DSS was developed in Visual Basic 6.0 programming language and provide data about tractors and implementation were selected and matched for paddy fields.In its application, a DSS can choose certain methods as problem solving solutions such as Multi Criteria Decision Making (MCDM).The use of DSS to assist management in solving problems has been widely carried out by researchers. In the field of education, DSS is used to select prospective high school students.This system selects students who will be sent to follow the quiz. To become a participant, there are not only achievement criteria and general knowledge, but also experience as an intelligent participant in the previous period. This decision support system is used by teachers and principals [2].In the business field, DSS can also be applied in selecting bonus receipts for salesmen.By using 4 criteria,

namely presence,achievement of goals, teamwork and behavior, this decision support system provides a list of salesman rankings [3].To assess employee performance, an Employee Performance Assessment System using the Simple Additive Weighting (SAW) Method has been created at the University of Muhammadiyah Purwokerto using the criteria for attendance, attitude/ethics, diligent, quality and quantity.The SAW method performs a simple weighting by weighting all the criteria and alternatives that produce the right reference value. The system helps the management to assess the performance of its employees [4].

One of the solution method in DSS is VIšekriterijumsko KOMpromisno Rangiranje (VIKOR). In this study the method used is VIKOR.VIKOR is one of the methods used in Multi Attribute Decision Making (MADM) by looking at the closest solution/alternative as an approach to the ideal solution in ranking.This method focuses on ranking and selecting from a number of alternatives even though the criteria are conflicting. The results of this study are expected to analyze the use of the VIKOR method in determining the best performing employees.

II. VIKOR METHOD

The VIKOR method is a multi Criteria Decision Making (MCDM). It was developedfor multi-criteria optimization of complex systems, solve decision problems with conflicting and noncommensurable criteria. It focuses on ranking and selecting from a set of alternatives in the conflicting criteria. The VIKOR method determines the compromise ranking list and the compromise solution obtained with the initial weights that is the closest to the ideal. This method is recommended for decision maker wants a solution that is the closest to the ideal [5]. The steps used in the VIKOR method include making Decision Matrix, determining Criteria Weight, calculating Normalization Matrix, calculating Utility Measures (S) and Regret Measures (R), and calculating VIKOR Index (Q) to obtain alternative rankings.

Decision Matrix

The decision matrix is formed from alternative data and criteria. Alternatives are employees who will be candidates as employees with the best performance.The criteria used in selecting employees with the best performance are 8 criteria, namely Present (C1), Late (C2), Service (C3), Complain (C4), Ability (C5), Empathy (C6), Commitment (C7), and Fault (C8).The value of each criterion is given in the number range from 1 to 100. Based on the assessment that has been made by the employee's supervisor, the employee (Alternatives) scores are obtained as shown in table 1.

Table1. Employee Assessment

No	Alternatives	Criteria							
		C1	C2	C3	C4	C5	C6	C7	C8
1	A1	100	20	85	5	80	20	84	63
2	A2	96	12	80	12	78	25	83	60
3	A3	92	20	84	15	86	25	91,5	55
4	A4	88	12	80	18	85	20	87	39,5
5	A5	84	16	87,5	22	86	35	85,5	50
6	A6	88	16	75	12	85	30	80	40
7	A7	100	20	78	26	80	25	80	45
8	A8	100	20	80	10	75	30	80,5	58
9	A9	92	16	83	20	80	35	85,5	43
10	A10	100	20	83	22	80	20	77	55

Criteria Weight

The weight of the criteria is needed to indicate the priority of the criteria used in the scoring system. The weight of the criteria in this case is determined by institutional regulations.Based on the general formula in determining the weight of the criteria, the total value of the total weight of the criteria is 1.On the Decision Support System For The Best Performing Employees Selection, the criteria that have the highest priority are Service and Ability. Weights of Criteria have been determined as in table 2.

Table 2. Weights of Criteria

No	Criteria	Weights (W)
1	Present (C1)	0,15
2	Late (C2)	0,1
3	Service (C3)	0,2
4	Complain (C4)	0,05
5	Ability (C5)	0,2
6	Empaty (C6)	0,1
7	Commitment (C7)	0,15
8	Fault (C8)	0,05

Normalization Matrix

Based on the decision matrix or employee assessment results, normalization can be obtained using the following formula:

$$N_{ij} = \left(\frac{f^{+} - f_{ij}}{f_j^{+} + f_j^{-}}\right) \quad (1)$$

Explanation:

N_{ij} : The i-th alternative response function on the j-th criteria

f^{+}_{j} : The best/positive value in the j-th criteria

f^{-}_{j} : The worst/negative value in the j-th criteria

i : 1,2,3, ..., m is the sequence number of alternative

j : 1,2,3, ..., n is the sequence number of attributes or criteria

Utility Measures (S) and Regret Measures (R)

Utility measure emphasize on maximum group utility andRegret Measure emphasize on minimum individual regret of the opponent. To calculate the value of S and R can use the following formula:

$$S = \sum_{j=1}^{n} W_j \left(\frac{x_j^{+} - x_j^{+}}{x_j^{+} - x_j^{-}}\right) \quad (2)$$

and

$$R_i = Max\, j \;\; w_j \left(\frac{x_j^{+} - x_j^{+}}{x_j^{+} - x_j^{-}}\right) \quad (3)$$

Explanation:

$Wj$is the weight of each j criteria

Siisweighted and normalizedManhattan distance.

Ri is the weighted and normalized Chebyshev distance.

Index VIKOR (Q)

VIKOR index value is calculated for each alternative. To calculate the VIKOR index use the following formula:

$$Q_i = \left[\frac{S_i - S^{+}}{S^{+} - S^{-}}\right] v + \left[\frac{R_i - R^{+}}{R^{+} - R^{-}}\right] (1 - v) \quad (4)$$

Explanation:

$S-$: min Si

$S+$: max Si

$R-$: min Ri

$R+$: max Ri

v : the value of v is 0.5

Ranking can be done based on the Q value. The alternative with the minimum Q score can be determined as the best rank with the following conditions:

$$Q(A^{(2)}) - Q(A^{(1)}) \geq DQ \quad (5)$$

where $A^{(2)}$ is the second-order alternative on the ranking of Q and $A^{(1)}$ is the second-order alternative on the ranking of Q and (1) is the alternative with the best order on the ranking of Q.While DQ=1 – (m-1), where m is the number of alternatives. Alternative $A^{(1)}$ must have the best rating on S and/or R.

III. CONFLICTING CRITERIA

The criteria that will be used in this study are taken based on the criteria set by the institutional regulations, namely: attendance discipline (present), late entry to work (late), service completion (service), complaints in service (complaint), ability to complete work (ability).), helping to complete the work of others (empaty), commitment to the organization (commitment) and violations (fault).The weight of the criteria that will be used in this study is as shown in table 1. The VIKOR method was chosen to solve this problem because it can selecting from a set of alternatives in the conflicting criteria.

In the problem of selecting employees with the best performance, there are several conflicting criteria, namely present vs late, service vs complaint and commitment vs fault.Institutional regulations require employees to be present every working hour and are not allowed to be late. Each employee has a task in a particular field. The institution expects employees to do their best without any complaints about their work.Other criteria that give conflicting values are commitment to the institution and employee violations. The violation is negligence outside the presence and target of work.

This problem can be solved using the VIKOR method by determining the positive and negative values as the ideal solution for each criteria.In this Decision Support System For Conflicting Criteria On The Best Performing Employees Selection, the best and worst data are also determined from the type of criteria.If the type of criteria is positive, then the best data is the data with the highest value, but if the type of criteria is negative, then the best data is the data with the lowest value. Types of criteria are arranged as in table 3.Based on the employee assessment data (Table 1), the best (maximum) and worst (minimum) values can be calculated as in Table 4.

Table 3. Type of Criteria

No	Criteria	Type
1	Present (C1)	Positive
2	Late (C2)	Negative
3	Service (C3)	Positive
4	Complain (C4)	Negative
5	Ability (C5)	Positive
6	Empaty (C6)	Positive
7	Commitment (C7)	Positive
8	Fault (C8)	Negative

Table 4. Max and Min Values of All Criteria

Value	Criteria							
	C1	C2	C3	C4	C5	C6	C7	C8
Max	100	12	87,5	5	86	35	91,5	39,5
Min	84	20	75	26	75	20	77	63

IV. VIKOR PROCESS

The first process carried out in the VIKOR method is to create a normalization matrix. Based on the assessment data on employees (Table 1), the results of the normalization of the overall data are as in table 5.

Table5. Normalization Matrix

No	Alternative	Criteria							
		C1	C2	C3	C4	C5	C6	C7	C8
1	A1	0	1	0,2	0	0,545455	1	0,517241	1
2	A2	0,25	0	0,6	0,333333	0,727273	0,666667	0,586207	0,87234

3	A3	0,5	1	0,28	0,47619	0	0,666667	0	0,659574
4	A4	0,75	0	0,6	0,619048	0,090909	1	0,310345	0
5	A5	1	0,5	0	0,809524	0	0	0,413793	0,446809
6	A6	0,75	0,5	1	0,333333	0,090909	0,333333	0,793103	0,021277
7	A7	0	1	0,76	1	0,545455	0,666667	0,793103	0,234043
8	A8	0	1	0,6	0,238095	1	0,333333	0,758621	0,787234
9	A9	0,5	0,5	0,36	0,714286	0,545455	0	0,413793	0,148936
10	A10	0	1	0,36	0,809524	0,545455	1	1	0,659574

After performing the normalization process, the results of normalization are multiplied by the weight of each criteria. The results are as in table 6.

Table6. Matrix Multiplied By Criteria Weight

No	Alternative	Criteria							
		C1	C2	C3	C4	C5	C6	C7	C8
1	A1	0	0,1	0,04	0	0,109	0,1	0,078	0,05
2	A2	0,038	0	0,12	0,017	0,145	0,067	0,088	0,044
3	A3	0,075	0,1	0,056	0,024	0	0,067	0	0,033
4	A4	0,113	0	0,12	0,031	0,018	0,1	0,047	0
5	A5	0,15	0,05	0	0,04	0	0	0,062	0,022
6	A6	0,113	0,05	0,2	0,017	0,018	0,033	0,119	0,001
7	A7	0	0,1	0,152	0,05	0,109	0,067	0,119	0,012
8	A8	0	0,1	0,12	0,012	0,2	0,033	0,114	0,039
9	A9	0,075	0,05	0,072	0,036	0,109	0	0,062	0,007
10	A10	0	0,1	0,072	0,04	0,109	0,1	0,15	0,033

The next process is to determine the value of S and R from each alternative. The results are as in table 7.

Table7. S and R Values

No	Alternative	S	R
1	A1	0,476677	0,109091
2	A2	0,517836	0,145455
3	A3	0,354455	0,1
4	A4	0,428186	0,12
5	A5	0,324886	0,15
6	A6	0,550711	0,2
7	A7	0,608425	0,152
8	A8	0,618393	0,2
9	A9	0,411321	0,109091
10	A10	0,604546	0,15

Based on the values of S and R for each alternative (table 7), it can be calculated the max and min values that will be used in the process of calculating the Q value. The results of the calculation of the max and min values of S and R can be shown in table 8.

Table8. (S and R) Max and Min Values

Alternative	S	R
Max	0,618393	0,2
Min	0,324886	0,1

Calculating the VIKOR index value or Q value is the last step that must be done in the VIKOR method. The best alternative ranking is indicated by the smallest Q value. The results in this study are as in table 9. Based on the results of the VIKOR index calculation, it can be concluded that the employee with the best performance is A3.

Table9.VIKOR Index Ranking Results

No	Alternative	Q
1	A3	0,050372
2	A9	0,1927
3	A5	0,25
4	A4	0,275976
5	A1	0,304037
6	A2	0,55597
7	A10	0,726411
8	A7	0,74302
9	A6	0,884702
10	A8	1

V. USER INTERFACE

Basically the application program is designed to help input alternative data, weights and create an assessment matrix. The program is made web-based using PHP programs and MySQL database. The program menu is arranged as shown in Figure 1.

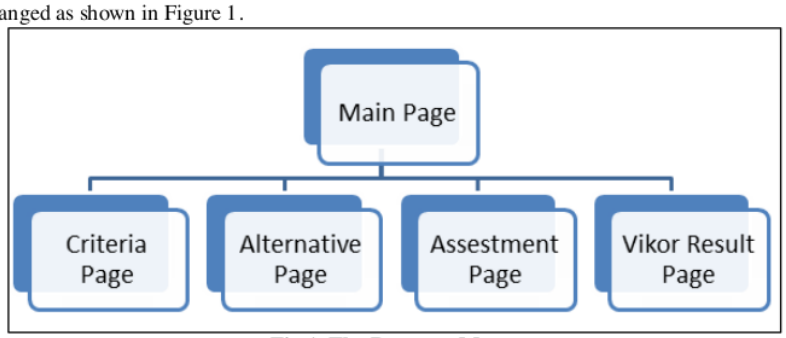

Fig.1. The Program Menu

Criteria Page

This page is used to accommodate the criteria used in the VIKOR method. On this page users can view, input and edit criteria data. The criteria page display as shown in Figure 2.

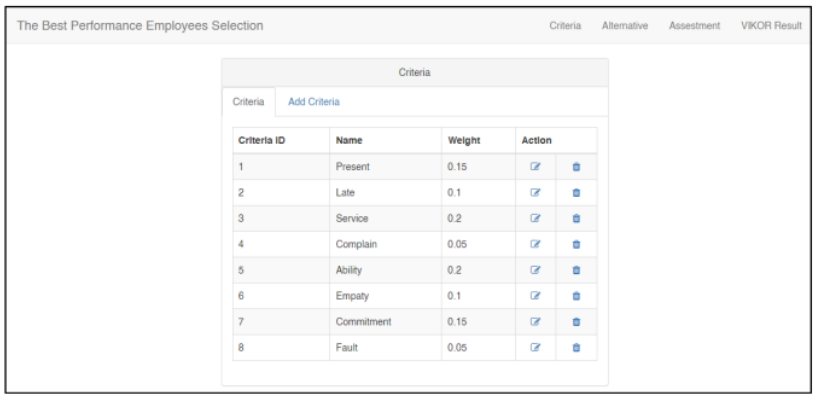

Fig.2. Criteria Page

Alternative Page

This page is used to add alternative data that will be selected as the best performing employee. On this page users can view, input and edit alternative data. Alternative page views as in picture 3.

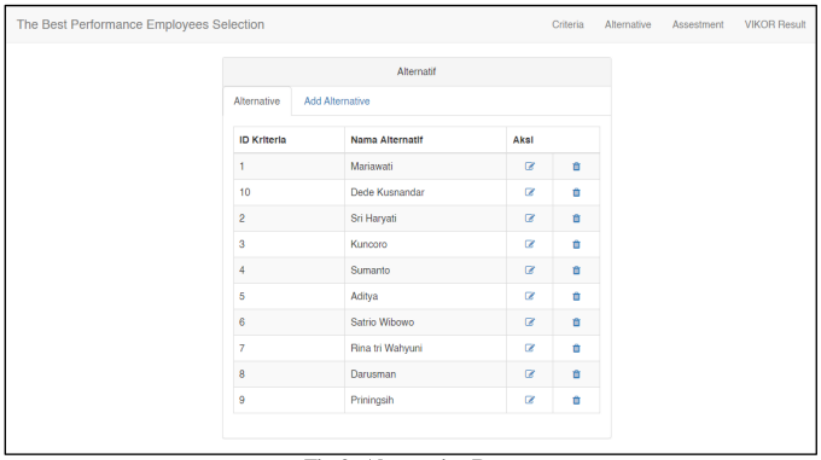

Fig.3. Alternative Page

Assessment Page

This page is used to input criteria value data for each alternative. Data input is done by selecting an alternative name and the name of the criteria first, followed by the value. Assessment page display as shown in Figure 4.

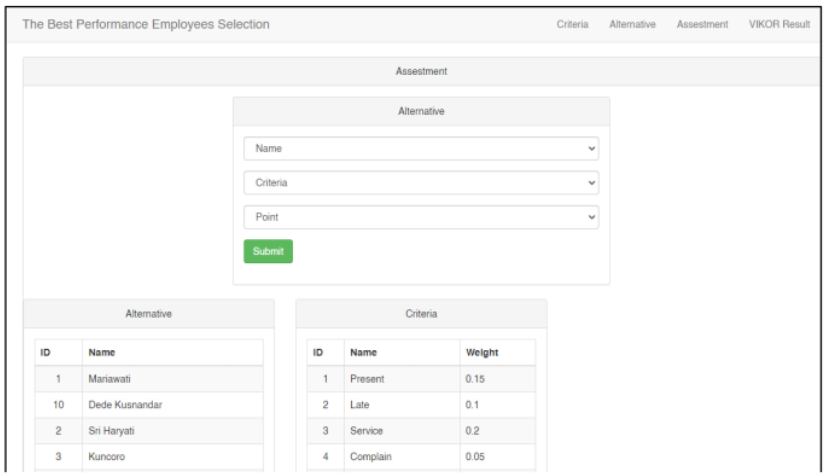

Fig.4. Assessment Page

VIKOR Result Page

This page is used to process the calculation of the Q value of each alternative. The ranking display is sorted from the alternative that has the smallest Q value. VIKOR Result Page page display as shown in Figure 5.

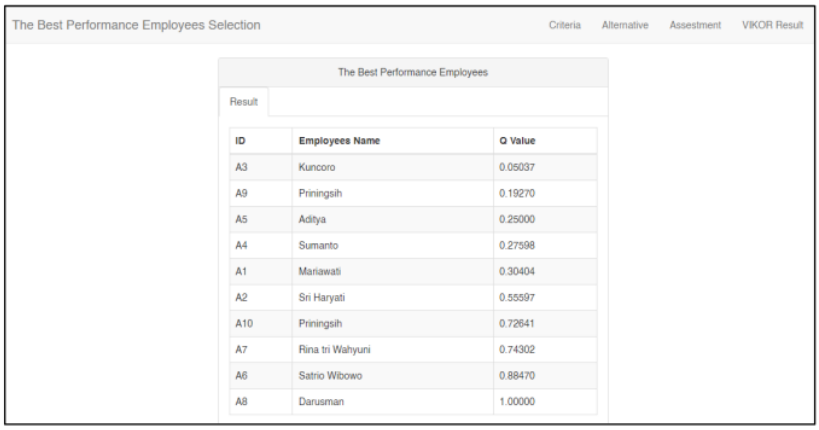

Fig.5. VIKOR Result Page

VI. CONCLUSION

Based on the results of the study, it can be concluded that the VIKOR method is easy to use for multi-criteria decision making with conflicting criteria.The VIKOR method can solve the problem well in the Decision Support System For The Best Performing Employees Selection.In terms of ranking, the determination of weights will affect the preference results of the best performing employees. In the present research, some inputs can be used as material to improve the research that has been done, including the range of criteria that can be tried to classify the data and combine it with other methods for weighting.

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