I.J. Modern Education and Computer Science, **2023, 2, 1-11**
Published Online on April 8, 2023 by MECS Press (http://www.mecs-press.org/)
DOI: 10.5815/ijmecs.2023.02.01

Comparison of Simple Additive Weighting Method and Weighted Performance Indicator Method for Lecturer Performance Assessment

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Received: 15 June, 2022; Revised: 20 July, 2022; Accepted: 24 August, 2022; Published: 08 April, 2023

Abstract: The development of methods for assessing lecturers' performance is needed to motivate lecturers to achieve institutional targets. Currently, lecturers are required to be able to adapt to the rapid development of technology. Lecturer performance assessment must be done periodically. Competence is measured as a basis for planning resource development activities. The method that is often used for assessing lecturer performance is the Simple Additive Weighting (SAW) method. However, the SAW method has drawbacks, namely 1) the process of determining criteria is only carried out by the leadership (subjective); 2) The SAW method can only be applied to multi-criteria data ; 3) Data ranking problems. Based on this deficiency, a new method was built, namely, the Weighted Performance Indicator (WPI) method using respondents' opinion to determine the criteria. This study aims to compare the performance of the two methods. Testing criteria using SPPS application dan WPI method, while testing methods utilized the SAW method and the WPI method. The results of the criterion test show the Percentage of Similarity of data validity = 96.7 % witht the minimum percentage limit (MPL) = 40%. While the results of the SAW method and WPI method testing resulted in the highest score in the 13th alternative, namely SAW score (v_{13}) = 793.76 and WP score (WP_{13}) = 0.928, and the lowest value in the 30th alternative, SAW score (v_{30}) = 18.60 and WP score (WP_{30}) = 0.140. the ranking positions in these two methods show similarities. However, for other alternatives, the rating value can be different.

The WPI method is a scientific development in the field of decision support systems that can be applied to other performance assessments, such other human resources, system performance assesment etc.

The results of this study prove that the WPI method can be used as a performance assessment method with different characteristics from the SAW method.

Index Terms: Comparison method, Simple Additive Weighting Method, Weighted Performance Indicator Method, Lecturer Performance Assesment, Respondents Opinion.

1. Introduction

One of the lecturer's challenges in facing the 4.0 Industry Revolution Era is conducting the lecture online. Nowadays, the lecturer should be able to operate the information technology device to do learn and teaching process. The human resources based on the lecturer performance assessment is implemented regularly once a year [1]. In Indonesia, the indicator of the lecturer performance assessment is based on the three pillars of higher education, there are teaching, research, community service, other tasks still utilized to measure the lecturer's target achievement [2]

According to [3], lecturers are professional educators and scientists with the main task of transforming, developing and disseminating science, technology, and art through education, research, and community service, known as the Tridharma of Higher Education.

Lecturers are one of the strategic and main factors in determining the level of success of students in carrying out the process of transforming science and technology as well as internalizing ethics and morals [4]. Lecturers who have higher qualifications, characteristics, and teaching competencies will perform better [5]. The competence of lecturers is very important to be developed, therefore the competence of lecturers must be evaluated in the right way in order to provide the right assessment [6].

There are some methods which utilize the performance assessment, such as Simple Additive Weighting (SAW), Analytic Hierarchy Process (AHP) [7], Profile Machine Method, Performance Prism, Multi-Faktor Evaluation Process (MFEP), Metode Graphic Rating Scale method, Balance Scorecard method, Profil Matching method, Weighted Product method [6], etc.

Generally, these methods utilized the data in the multi-objective or multi-criteria form. It was defined as the number of alternative assessments [8]. The multi-criteria consist of some data composition which showed in the hierarchy form. Utilizing the multi-criteria attribute most known as *Multiple Criteria Decision Making* (MCDM).

In the MCDM method most widely used method is the SAW method [9–11] . SAW is a classical method that can be applied to take the best alternative. However, the SAW method has weaknesses, there is the criteria are only in the form of single data, ranking problems, and the subjectivity of the leadership in determining the criteria is often burdensome so it is difficult to achieve.

Some research shows that developing the performance assessment model just utilizing the SAW method gives the not maximal result. According to Aziz T F etc (2020) to avoid subjectivity, the research should combine the SAW method and Borda calculation. Borda is a group decision support method which utilized the assessor references value and weight value to result in the rank score [12], according to Daniawan (2018), the performance lecturer assessment by utilized two methods, the Analytical Hierarchy Process (AHP) method for weighting and the Simple Addictive Weighting (SAW) method for ranking, since not discovered yet the effective and efficient performance lecturer assessment method [13]. According to Rizal Pahlepi (2020), the SAW method is combined with the TOPSIS method to result in the more accurate assessment. To overcome this problem, a new method was developed that can overcome this problem.

Nowadays, the respondent opinion has significantly affected the taking decision, such as in the presidential election [14–16] and to determine key performance indicators (KPIs) [17,18], etc. The public opinion or respondent opinion provides a strong value in the taking decision.

Some research utilized public opinion as a base in determining the policy, for example, political policy [19], government authority policy, etc [20]. Therefore, the public opinion or respondent opinion could be a reference for the leaders to determine the performance assessment criteria. Based on their thoughts, has developed the Weighted Performance Indicator method (WPI method) using opinions of respondents for Lecturer performance appraisal [21,22].

Previously, research on the WPI method had been done [21]. This study aims to compare the determination of criteria and assessment of weighting using the SAW method and the WPI method. The results of this study are expected to prove whether the WPI method can be used as a better performance assessment method than the SAW method.

2. Literatur Review

2.1. Simple Additive Weighting (SAW)Method

SAW is a decision-maker multi-criteria method for calculating the weight. SAW is a classic method that is easy to applicate to help leaders in the taking decision [23,24].

The basic concept of the SAW method is to find the weighted calculation of the performance rating on each alternative on all of the attributes. SAW method is required a normalization decision matrix process (X) to the scale which is comparable to all available rating alternatives.

Matrix normalization by dividing the alternative attribute value with the available attribute based on the equality which is adjusted to the attribute kind. Where the attribute kind consisted of two, there is a benefit or costs with equality. The reference value for each alternative (R_{ij}) is shown in equation (1):

$$R_{ij} = \begin{cases} \frac{x_{ij}}{Max_i\ x} \\ \frac{Min_i\ x_{ij}}{x_{ij}} \end{cases} \quad (1)$$

Where: R_{ij} is the performance rating normalized value, max x is the biggest value of each criterion, min x is the smallest value of each criterion, and x is the attribute value owned by each criterion.

The reference value for each alternative (V_i) is shown in equation (2):

$$V_i = \sum_{j=1}^{n} w_j r_{ij} \quad (2)$$

Where r_{ij} is a performance rating normalized of the A_1 alternative on the C_j attribute i = 1,2,3…m dan j = 1,2,3…n

The value of V_1 is bigger, it shows that the A_1 alternative is selected. According to Fishburn and MacCrimmon, there are some steps in the settlement of the SAW method as below:

1) Determined the criteria (C_i) which could become a reference in the taking decision process (V_i)
2) Determined the rating compatibility of each alternative on each criterion
3) Create a decision matrix based on the criteria (C_i), and then normalize the matrix based on the equality which is adjusted to the attribute kind (benefit or cost until the matrix is normalized R.
4) The final result wich from the ranking process is the summation of the normalization matrix multiplication R with weight vector preferential until getting the biggest value which selected as the best alternative (A_i)

SAW method can select some alternatives by calculating the weight value for each attribute and then continue with the ranking process. This assessment is the right method since it was a reference to the determined criteria value and weight preferential. However, the weight determination for each criterion is also become a weakness of the method, since the determination of the criteria and weight has been done by the leader subjectively. This condition could be burdensome for the lecturer. Besides that the incorrect criteria and data determination could lead to a problem in the ranking calculation, such as a qualitative criteria selection could be resulting in an uncertain structure [25,26].

2.2. Weighted Performance Indicator (WPI) Method

The difference between the Weighted Performance Indicator model based on opinion respondents and the other performance assessment model is in the process which determined the criteria and weight value. This model is shown on the hierarchy tree from the original form data questionary. The hierarchy tree structure has a top position namely as a top-level. The top-level position, divided to be some criteria. The criteria have some sub criteria that has a different characteristic. Each dimension can be breakdown to some level with some indicator and item which correlated with each other. Weighted Performance Indicator model is designed with adopted some stage on the apriori algorithm is compile the data in the hierarchy tree form, encoded item table and determined the minimum support value. Whereas to calculate the weight value, development of the weight calculation [27].

The step to construct the Weighted Performance Indicator model based on the opinion of respondents is as below:

1) Determined the Criteria,

Criteria are determined based on the respondent's opinion through a questionary that is provided to the respondent. The questionary consisted of several questions with the answer to more than one and allow to add the item from respondent.

2) Designed a hierarchy tree structure

Designed the tree made easier the classification data process. Data will be grouped based on the dimension or criteria. The grouping process is shape the hierarchy tree structure to several levels. The hierarchy tree resulted in a foundation to create an encoded item table. Figure 1 hierarchy tree form.

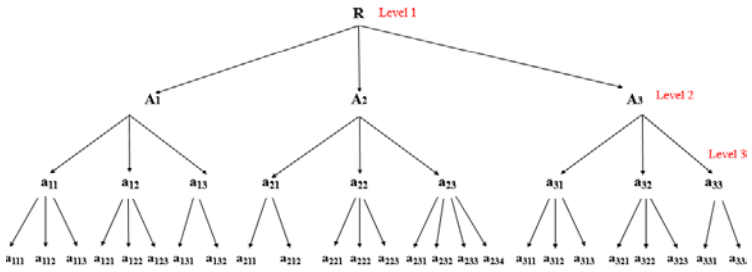

Fig. 1. Hierarchical Tree Structure For Indicators For Performance Appraisal

3) Collecting data

Collecting data consisted of 2 phases. The first phase is to examine the criteria. All respondents can be involved to provide an assessment. The respondents are required to give a response whether the criteria proposed qualified to be the indicator or not.

The second phase is collecting data on lecturer performance assessment. The second phase is conducted after all criteria fulfill the minimum support value (min_s). The questionary was given to 30 lectures. The lectures should choose one answer, there are yes or no. Data converted to encoded item table. Creating a table of encoded items is changing the items at the last level to numeric 1 and 0. Point for selected by the respondent = 1, point for not selected = 0. The more respondents chose, the higher the frequency. Below is an example of an encoded item table, shown in table 1.

Table 1. Encoded Item Table

R	A_1				A_2				A_i			
	a_{11}		a_{12}		a_{21}		a_{22}		a_{31}		a_{ij}	
	a_{111}	a_{112}	a_{121}	a_{122}	a_{211}	a_{212}	a_{221}	a_{22}	a_{311}	a_{312}	a_{321}	a_{ijk}
1	0	0	1	1	0	0	1	1	0	1	0	0
2	0	1	1	0	1	0	0	1	1	0	1	0
3	1	0	1	1	1	0	0	0	0	1	0	1
4	1	1	0	0	0	1	0	1	1	0	1	0
5	1	0	0	1	0	1	0	1	1	1	0	1
6	0	1	0	0	0	1	0	0	0	1	0	0
7	0	1	0	0	1	1	0	0	1	0	0	1
8	1	1	0	1	0	1	0	1	1	0	1	0
9	1	0	0	0	0	0	0	0	1	0	0	0
10	0	1	0	0	0	1	0	1	1	0	1	0

Where: A_1, A_2, and A_3 are criteria, a_{ij} are sub criteria level 2, a_{ijk} are subcriteria level 3.

4) Calculating the minimum support value (mins)

Based on the encoded item table result, the next step is calculating the total of each item determined by the Minimum Support Value (MPL). In this step, minimum support is a tolerance value determined as a minimum limit. The formula below:

$$\min_s = mpl \text{ x n} \tag{3}$$

For Example, mins = 30% x 10= 3, the minimum support value is 3. Determined the minimum support value which is less than 3, means it is ineligible and no further process. In this step, the ineligible item will be eliminated. After that, merge the minimum support item in the table. The merger is meant to delete the ineligible data minimum support to make easy the next calculation process.

5) Calculating the value of the weight criteria (w_i)

Based on the table item encoding, all sub-criteria values are accumulated. the more respondents who choose indicates a high level of respondent confidence. The formula is explained as follows: r is a factor. Example Vector a_i , i = 1, 2, ... r, has criteria, namely a_{ij} , for j = 1, 2, …., ni. Defined :

$$a_{ijk} = \left\{ \frac{1, \text{selected respondent}}{0, \text{not selected respondent}} \right\}$$

Therefore, the formula calculates the absolute frequency in subcriteria (t_{ijk}), the formula is shown in equation (4)

$$t_{ijk} = \sum_{i=1}^{n} a_{ijk} \tag{4}$$

Where i = 1, 2, ... r, dan j = 1, 2, ... ni; n = number of respondents, a_{ijk} = respondent's choice value.

Before calculating the weight of the criteria at level-1, the value of all criteria at the last level is calculated. The absolute frequency on criteria (T_i) is shown in equation (5).

$$T_i = \sum_{k=1}^{ni} t_{ijk} \tag{5}$$

then calculated the weight value for each criterion (w_i), the formula is shown in equation (6)

$$w_i = \frac{T_i}{\sum_{i=1}^{r} T_i} \tag{6}$$

6) Calculating the weight on sub-criteria (wijk)

The next step is to calculate the weight value at the criteria. Equation (6) is the weight value of the sub-criteria (W_{ijk}). The formula is shown in equation (7).

$$w_{ijk} = \frac{t_{ijk}}{T_i} w_i \tag{7}$$

This calculation is carried out for all criteria until all criteria have a weighted value. If the data composition is more than two levels, then the formula can be used by adding parameters. If all the weight values are added up, the total value is 1.

7) Determining the Minimum Standard Value for Assessment (MSV)

The standard value for assessment (MSV) is the minimum score that must be achieved by the lecturer. MSV is determined by the leadership to be the minimum value that must be achieved.

8) Calculating the value of Weighted Performance (wp_x)

wp_x is the sum of the weight values obtained based on the performance. This value is a score of lecturer performance achievement.

3. Method

3.1. Database

Data utilized is data of lecturers at Palembang city. The sample was collected by spreading the questionnaire to 40 respondents randomly. The questionnaire which has been answered is 30 data. Therefore, the number of the sample used in this study is 30 data. The data collection technique is simple random sampling. Simple random sampling has an external validity high level in the representative the biggest population characteristic.

3.2. Criteria Determination

Table 2. Criteria for Performance Lecturer Assessment

Criteria	**Sub-criteria level 2**	**Sub-criteria level 3**
A_1. Teaching Activities	Teaching (a_{11})	Full Daring (a_{111})
		Blended learning (a_{112})
		Offline (a_{113})
	Release Book (a_{12})	Modul (a_{121})
		Handout (a_{122})
		Reference (a_{123})
	Guide Student (a_{13})	Student Diploma and Student Undergraduate (a_{131})
		Postgraduate (a_{132})
A_2. Research Activities	Copyright (a_{21})	copyright (a_{211})
		Patent (a_{12})
	Research Kind (a_{22})	Internal Grant (a_{221})
		Eksternal Grant (a_{222})
		Independent (a_{223})
	Journal Publication (a_{23})	Reputable journal (a_{231})
		International (a_{232})
		National (a_{233})
		Non Acredited (a_{234})
A_3. Community Service	Committee (a_{31})	Eksternal (c_{311})
		Internal (c_{312})
		Regional (c_{313})
	Research Community Services (a_{32})	Internal (c_{321})
		Eksternal (c_{322})
		Independent (c_{323})
	Publication (a_{33})	International (c_{331})
		National (c_{332})

The questionnaire data is a multi-criteria form, and consists of 3 criteria, they are teaching activities, research activities, and community service activities. Every criteria has sub criteria until 2 levels low with a total of 25 sub-criteria. The item is a label based on the hierarchy level so it is easy to track. Table 2 showed 25 item questionnaire used in this study.

4. Results and Discussion

The purpose of model testing is to find out whether the designed model can be used as a performance assesment model. The test uses data on the performance of lecturers as a sample. The number of samples is 30. At this stage the testing is carried out in two stages, namely the testing of criteria and testing of the model. Table 3 is a collection of data from respondents' opinions which is used as a dataset in this study.

Table 3. Data collection from respondents' opinions

R	A_1																								
	a_{11}			a_{12}			a_{13}		a_{21}		a_{22}			a_{23}				a_{31}			c_{32}			c_{33}	
	a_{111}	a_{112}	a_{113}	a_{121}	a_{122}	a_{123}	a_{131}	a_{132}	a_{211}	a_{212}	a_{221}	a_{222}	a_{223}	a_{231}	a_{232}	a_{233}	a_{234}	a_{311}	a_{312}	a_{313}	a_{321}	a_{322}	a_{323}	a_{331}	a_{332}
1	1	1	0	0	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	0	1	1	1
2	1	0	1	0	1	1	0	0	1	0	1	0	0	0	0	0	0	1	1	0	1	0	1	1	0
3	1	1	0	1	1	1	1	1	1	1	1	0	0	1	1	1	0	1	1	1	0	1	1	1	1
4	1	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	1	0	0
5	1	1	1	1	1	0	1	1	1	1	1	0	0	1	0	0	1	1	1	1	1	1	1	0	1
6	1	1	1	1	1	0	0	0	0	1	0	0	1	1	0	0	1	0	1	1	1	1	1	0	0
7	1	1	1	1	0	0	0	0	1	1	0	0	1	0	1	1	1	0	1	1	1	1	0	0	0
8	1	1	1	0	0	0	0	1	1	1	1	1	1	0	0	1	1	0	1	1	1	0	0	0	0
9	1	1	1	1	0	0	1	1	1	1	0	0	1	1	0	0	1	0	1	1	1	1	0	0	1
10	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	1	0	0	1	1	1	1	1	1	1
11	1	1	1	1	0	1	0	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	0	1	0
12	1	0	0	1	0	0	0	1	1	1	1	0	0	1	1	1	1	1	1	0	0	1	0	0	0
13	1	1	1	1	0	0	1	1	1	1	1	1	0	1	1	0	0	1	1	1	1	1	0	0	1
14	1	1	0	1	1	1	0	1	1	1	1	0	0	1	1	0	1	0	1	1	0	1	1	1	0
n_{30}	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0

Based on table 3, the WPI method is tested by calculating the absolute frequent for the sub-criteria (t_{ijk}) and min_s. The formula to calculate t_{ijk} uses equation (3). The calculation of tijk is as follows:

$t_{111} = 29$ $t_{112} = 19$ $t_{113} = 10$ $t_{121} = 21$ $t_{122} = 10$ $t_{123} = 9$ $t_{131} = 19$
$t_{132} = 17$ $t_{211} = 25$ $t_{212} = 17$ $t_{221} = 23$ $t_{222} = 21$ $t_{223} = 8$ $t_{231} = 16$
$t_{232} = 11$ $t_{233} = 18$ $t_{234} = 9$ $t_{311} = 20$ $t_{312} = 25$ $t_{313} = 8$ $t_{321} = 26$
$t_{322} = 19$ $t_{323} = 10$ $t_{331} = 21$ $t_{332} = 27$

4.1. Comparing The Results of Criteria Validation Tests Using The WPI method and SPSS Methods

The criteria test aims to compare the results of determining criteria using the WPI method and SPSS application. This test will compare the results of the two methods, whether they have the highest similarity, what is the percentage of similarity, and other useful findings to make a conclusion.

Testing using the WPI method, the determination of the criteria was done by eliminating the criteria which not achieve the minimum support value (min_S). The first step was done transform the data into an encoded item table. The data was summed up based on each criteria. The Minimum Support Value (MPL) = 40%, then the support minimum value (min_S) is 40% x 30 = 12. If $t_{ijk} > min_s$, then the sub-criteria value meets the requirements. Based on the minus value, only 17 sub-criteria are eligible and 7 sub-criteria are not eligible. The item which does not achieve min_s can not become a measuring instrument. The results of the criteria testing using the WPI method are shown in table 4 below.

Table 4. Data Validity Examination Result utilized WPI method

sub-criteria	a_{111}	a_{112}	a_{113}	a_{121}	a_{122}	a_{123}	a_{131}	a_{132}	a_{211}	a_{212}	a_{221}	a_{222}	a_{223}
t_{ijk}	29	19	10	21	10	9	19	17	25	17	23	21	8
min_s	12												
$t_{ijk} > min_s$	T	T	F	T	F	F	T	T	T	T	T	T	F

sub-criteria	a_{231}	a_{232}	a_{233}	a_{234}	a_{311}	a_{312}	a_{313}	a_{321}	a_{322}	a_{323}	a_{331}	a_{332}
t_{ijk}	16	11	18	9	20	25	8	26	19	10	21	27
min_s	12											
$t_{ijk} > min_s$	T	F	T	F	T	T	F	T	T	F	T	T

**Where : T is true, F is False

Testing the criteria using the SPSS application using the Guttman scale. Data validity testing using Bivariate Pearson with correlation, α = 0.210; r table = 0.05. If Coefficient Validity > α, then the item is valid. The data utilized is a dataset which the same as the WPI method data. The results of the validity test are shown in table 5.

Table 5. Data Validity Examination Result utilized SPSS aplication

sub-criteria	a_{111}	a_{112}	a_{113}	a_{121}	a_{122}	a_{123}	a_{131}	a_{132}	a_{211}	a_{212}	a_{221}	a_{222}	a_{223}
Coefficient Validity	0.388	0.447	0.103	0.467	0.069	0.134	0.363	0.635	0.522	0.537	0.579	0.449	0.132
r table ; df = 28 ; α	0.210												
Coefficient Validity > α	T	T	F	T	F	F	T	T	T	T	T	T	F

sub-criteria	a_{231}	a_{232}	a_{233}	a_{234}	a_{311}	a_{312}	a_{313}	a_{321}	a_{322}	a_{323}	a_{331}	a_{332}
Coefficient Validity	0.478	0.351	0.134	0.396	0.479	0.352	0.487	0.363	0.224	0.467	0.346	0.478
r table ; df = 28 ; α	0.210											
Coefficient Validity > α	T	F	T	F	T	T	F	T	T	F	T	T

**Where : T is true, F is False

The test results from the SPSS application yielded 17 valid items. According to Ghozali [28] saying that Cronbach's Alpha is acceptable if the Cronbach's Alpha value is > 0.6. The closer Cronbach's alpha is to 1, the higher the internal consistency. The results of the validity test obtained the value of Cronbach's Alpha = 0.699, the higher the Cronbach Alpha value, then the value of data reliability is getting better and the instrument is declared reliable [29]. Cronbach's Alpha values are shown in Table 6.

Table 6. Reliability Statistics

Reliability Statistics	
Cronbach's Alpha	N of Items
.699	26

Based on the results of testing the validity of the two methods, the criteria similarity value = 96.7%. To get a clearer conclusion, the WPI method was re-tested for the MPL values of 10% until 70%. The test results are described in table 7 below.

Table 7. The results of testing the MPL value

MPL	Percentage of similarity
10	76.7
20	76.7
30	90.0
40	96.7
50	96.7
60	83.3
70	60.0

Based on table 7, The experiment was carried out 7 times. Experiments at 40% and 50% MPL values obtained a similarity value of 96.7%. This proves that the determination of criteria using the WPI method has high similarity, so it can be concluded that the determination of criteria using the WPI method can be used as a measuring tool.

4.2. Comparison of the results of the weighting between the WPI method and the SAW method

The purpose of the comparison method is to determine the results and differences between the WPI method and the SAW method. The difference between the WPI method and the SAW method is that the WPI method involves the respondent in making decisions, while in the SAW method the decision is made by the leadership. The similarity of the SAW method and the WPI method is to use weight calculations. The purpose of the SAW method is to find the best alternative, while the SAW method is to find an alternative that meets the assessment requirements.

1) Calculating the value of the weight on the sub-criteria (w_{ijk})

The value of the weight on the sub-criteria (w_{ijk}) using the formula in equation (6), with the following calculations:

W_{111} = 29/105 x 0.29 = 0.080
W_{112} = 19/105 x 0.29 = 0.052
W_{121} = 21/105 x 0.29 = 0.058
W_{131} = 19/105 x 0.29 = 0.052
W_{132} = 17/105 x 0.29 = 0.047

W_{211} = 25/120 x 0.33 = 0.069
W_{212} = 17/120 x 0.33 = 0.047
W_{212} = 17/120 x 0.33 = 0.047
W_{221} = 21/120 x 0.33 = 0.058

W_{232} = 11/120 x 0.33 = 0.030
W_{233} = 18/120 x 0.33 = 0.050
W_{321} = 26/138 x 0.38 = 0.072
W_{322} = 19/138 x 0.38 = 0.052

The results of these calculations, the highest weight on w_{111}= 0.08 and the lowest weight on w_{232} = 0.03.

2) Calculate the alternative value (V_i) in the SAW method

Based on the SAW method, the determination of the weight is based on the equation (2). The SAW method can not be used on criteria more than level 2. Therefore, the weight calculation is only up to level 2. Table 8 shows the results of weight calculations using the SAW method and the WPI method.

Table 8. The result of the weight value calculation for each criterion

Criteria	**Sub-criteria (level 2)**	**Sub-criteria (level 3)**	**value**	
			V_i	**WP_x**
A_1. Teaching Activities	Teaching (a_{11})	Full Daring (a_{111}	0.13	0.08
		Blended learning (a_{112})		0.05
	Release Book (a_{12})	Modul (a_{121})	0.06	0.06
	Guide Student (a_{13})	Student Diploma and Student Undergraduate (a_{131})	0.1	0.05
		Postgraduate (a_{132})		0.05
A_2. Research Activities	Copyright (a_{21})	Copyright (a_{211}	0.12	0.07
		Patent (a_{12})		0.05
	Research Kind (a_{22})	Internal Grant (a_{221})	0.09	0.06
		Eksternal Grant (a_{222})		0.03
	Journal Publication (a_{23})	Reputable journal (a_{231})	0.12	0.04
		International (a_{232})		0.03
		National (a_{233})		0.05
A_3. Community Service	Committee (a_{31})	Eksternal (c_{311})	0.12	0.06
		Internal (c_{312})		0.07
	Research Community Services (a_{32})	Internal (c_{321})	0.07	0.07
		Eksternal (c_{322})		0.05
	Publication (a_{33})	Eksternal (c_{331})	0.13	0.06
		International (c_{332})		0.07

Calculation of weights using a sample = 30 respondents. The Respondents data comes from teaching and learning activities, research, and community service from lecturers from the city of Palembang. The data will be tested on both methods. Table 9 shows the final results of both methods. The final value of the SAW method is to calculate the preference value (V_i), while the final value of the WPI method (wp_x) is to calculate the weight value of each item. Table 9 shows the results of the assessment.

Table 9. Final value for SAW method and WFI method

Num	**Initial**	**SAW score (v_i)**	**WPI score (wp_x)**	**Num**	**Initial**	**SAW score (v_i)**	**WPI score (wp_x)**
1	AS	89.49	0.920	16	HR	93.76	0.928
2	TA	53.93	0.366	17	AD	85.42	0.708
3	HD	92.52	0.893	18	AD	86.98	0.848
4	NA	40.88	0.322	19	HM	83.10	0.747
5	HS	90.04	0.813	20	MP	85.00	0.755
6	SP	61.48	0.421	21	BU	85.74	0.771
7	HA	76.76	0.562	22	NA	88.25	0.890
8	TY	68.13	0.540	23	AB	86.40	0.810
9	LM	66.32	0.501	24	SP	80.89	0.752
10	RW	92.52	0.865	25	BR	83.92	0.725
11	JA	93.02	0.868	26	OC	78.25	0.667
12	RM	90.38	0.840	27	MT	39.17	0.394
13	ES	**93.76**	**0.928**	28	FA	76.12	0.603
14	VA	86.82	0.736	29	MI	75.86	0.625
15	HR	85.00	0.791	30	WD	**18.60**	**0.140**

The results of calculations utilized the SAW method, the highest value is at v_{13} = 93.76, and the lowest is at v_{30} = 18.60. In the WPI method the highest value is at wp_{13} = 0.928, and the lowest value is at wp_{30} = 0.140. Respondents who got the highest or lowest score in both methods referred to the same respondent, but for the assessment of other respondents, the ranking values could be different. The difference occurs because in the SAW method, the final value is multiplication normalized matrix R with a weight vector, so that the largest value that selected as the best alternative (Ai) as the solution. In the WPI method, the final value is the sum of the weighted values that identify that the activity was carried out.

The SAW method and the WPI method are two different methods. The comparative analysis of the methods carried out at this stage aims to determine the differences in the characteristics of the two methods. Table 10 describes the differences in characteristics between the WPI method and the SAW method.

Table 10. Characteristic differences between the WPI method and the SAW method.

Characteristic	SAW method	WPI method
Determination of criteria	Leader	Respondents Opinion
Determination of weight value	Leader decision	Frequensi absolut
Composition data	Multi-criteria	Multi-criteria Multi-level
Goal	Best alternative	Performance Assessment
Data manipulation table	Matrix normalization	Encoded item table
Formula	Benefit and cost value (r_{ij}), The reference value (V_i)	Weight dimension Value (w_i), weight item value (w_{ijk}).
Result	Ranking	Weight performance value (WP_x)

The difference between these two methods is very significant. The goals of these two methods show different things. This method is a novelty in the field of decision support systems.

5. Conclusion

WPI method is not a development of the SAW method. The WPI method was created because to overcome the problems in the SAW method, namely subjective assessment and ranking problems [30]. In addition, this method is also able to overcome complex data models with multi-criteria and multi-level forms.

The WPI method can be applied to multi-criteria and multi-level data. This method has no level limit. Weight calculation only applies to the last level and level -1, so this method can be used in multilevel data models.

Each sub-criteria has a weight that depends on the number of respondents' choices. The importance of the criteria depends on the number of choices by the respondent. The more respondents choose the criteria, the criteria have a high importance value.

The differences in the characteristics of the two methods result in the same and different test values. In the WPI method, the criterion test at the MPL value = 40% produces a similarity value of 96.7%. This proves that the technique of determining criteria using respondent's opinion has been tested and can be used as a measuring tool. However, at the stage of calculating the results, it produces different values.

The results of the criteria test resulted in a similarity value of 96.7%. number of valid criteria = 17 items. Base on the SPSS test, the value of Cronbach's Alpha = 0.699. This proves that the technique of determining criteria using respondents' opinions has a high validity value, so it can be used as a measuring tool.

The development of a performance appraisal method utilized the weighted performance indicator (WPI) method is a new method with a different approach. The WPI method contributes to the development of knowledge, especially in the field of decision support systems.

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How to cite this paper: Terttiaavini, Yusuf Hartono, Ermatita, Dian Palupi Rini, "Comparison of Simple Additive Weighting Method and Weighted Performance Indicator Method for Lecturer Performance Assessment", International Journal of Modern Education and Computer Science(IJMECS), Vol.15, No.2, pp. 1-11, 2023. DOI:10.5815/ijmecs.2023.02.01