COMPETITIVE CANDIDATE DETERMINATION SYSTEM FOR STUDENTS WITH COMPARATIVE ANALYSIS OF WEIGHTED PRODUCT (WP) ALGORITHM AND TECHNIQUE FOR ORDER BY SIMILARITY (TOPSIS)

HANDRIZAL, ELVIWANI, ARIF KURNIAWAN

Department of Computer Science, Faculty of Computer Science and Information Technology, Universitas Sumatera Utara, Jl. University No. 9-A, Medan 20155, Indonesia

E-mail: handrizal@usu.ac.id

ABSTRACT

The competition will be one of the indicators that make a university at its best. The more students who take part in competitions will certainly have a positive impact on the university itself. The achievements and victories achieved by students are interpreted as a form of university success in educating students both in terms of theory and practical skills. The track record of student achievement will always make the accreditation of a university even better because it presents graduates who are competent in their fields. The selection process will be something that needs to be done considering that many criteria must be met by the student before being declared ready to compete for both in theory and practice so that a decision support system is needed that can provide recommendations for student choices. This research will discuss the process of determining the candidate for the race by analyzing two methods, namely the Weighted Product (WP) method and the Technique for Order by Similarity to Ideal Solution (TOPSIS) method in which the two methods will analyze what percentage of the resulting level of accuracy is the output on the system is the same as the manual calculation. Furthermore, the writer will also analyze how far the difference is between the two methods using Euclidean Distance and the weighting of the criteria using a Likert Scale. The results of the comparative analysis show that the WP method is the best method with a value of 0.14281 because it has a value close to zero compared to the TOPSIS method with a value of 0.51238 even though both produce the same level of accuracy reaching 100%, but the WP method is still more optimal in terms of program execution speed (Micro time) with an average time of 0.0781 seconds while the TOPSIS method takes an average of 0.2234 seconds

Keywords: Decision Support System, Candidate Participants, Likert Scale, Weighted Product, Technique for Order by Similarity to Ideal Solution, Euclidean Distance

1. INTRODUCTION

The best way to win the competition is to take advantage of technology. Building information technology-based systems in a precise, structured and simple manner is very important for the competitive advantage of modern companies and organizations. In the world of higher education, higher education is an effective place to transform knowledge and also a means of student education. Every college wants students who can implement their academic potential to reach achievements.

Faculty of computer science and information technology the Universitas Sumatera Utara always sends students every year to take part in competitions both in the field of technology and other competitive fields, but there is rarely a selection process for students who want to take part in competitions and there are no suitable parameters for objective assessment. Students sometimes register themselves if there is a competition without a selection process in it so there is a lack of preparation to compete.

One reason for choosing this topic was because the selection process was limited to filing and tended to take a long time to announce the participants who passed because it was still done manually, such as announcing it through paper
affixed to the campus wall magazine. Each campus in selecting students for the competition should be done based on the criteria for academic aspects. For that, it is necessary to make web-based DSS software in this context.

Web technology has been increasing and improving in the last few years and it becomes one of the major improvements in the Information Technology (IT) world [1]. PHP is a "strong" language used in developing dynamic and interactive web applications. This is because of one of the defining features that PHP offers developers, namely the ease to connect and manipulate databases due to the built-in Database function provided by PHP itself. Apart from that, PHP is a powerful language because it offers several key advantages, such as performance, scalability, open-source, and portability [2]. The micro time function is one of the PHP functions used to restore the current Unix timestamp with units of microseconds [3].

Weighted Product (WP) and Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) are methods widely used to assist in making decisions. For instance, TOPSIS is used to rank attributes or criteria, rank suppliers, and evaluate optimal generation. Meanwhile, WP is used to calculate the attribute weights evaluate optimal generation, and evaluate the optimum generation of a particular [4].

Euclidean distance technique is an identification and classification technique based on Euclidean metrics that are related to trial and error, where the distance between points is related to the length of the line between them. The Euclidean distance is calculated using the Pythagorean formula [5].

The Likert scale is a measurement scale developed by Likert in 1932. In his discussion, he provides interpretation results in the form of an "opinion survey" [6]. This scale has four or more question items that are combined to form a score/value that represents individual traits, for example, knowledge, attitudes, and behavior. In the data analysis process, a composite score, usually the sum or average, of all the questions can be used. Five-point Likert scale with a weighted scoring range of 0–100 and which is a reliable measure of usability.

In the comparative analysis, the writer will compare it with Euclidean Distance to see how far the difference is between the two algorithms used and comparing the execution speed of the two methods using the Microtime function in PHP programming.

2. RELEVANT RESEARCH

In previous research conducted by Agus Setyawan, Florentina Yuni Arini, and Isa Akhli [7] in 2017 entitled "Comparative Analysis of Simple Additive Weighting Methods and Weighted Product Methods Against the New Employee Recruitment Decision Support System (DSS) at PT. Warta Media Nusantara ", the test results show that the average execution time of the SAW method is 0.4106s while the execution time of the WP method is 0.92s. Average execution time is obtained by dividing the total execution time by the number of trials. From the average implementation time, it is known that the SAW method is faster in calculating the New Employee Recruitment Decision Support System than the WP method. This is because the SAW method uses a simpler calculation method than the WP method so that the required process is less. This is similar to research [8] which explains that the simplicity of the calculation makes the SAW method the fastest method in the calculation process compared to other MADM methods.

Research conducted by S Oktaviana, A Rozzaaq, and D A Rosatama in 2018 entitled "Comparative analysis using the WP and TOPSIS methods to find the best mountains for hiking", the test results show that the WP method to be the best order with 100%. For the Accuracy calculation value, the TOPSIS method becomes the second-best method with a percentage of 98.82% [9].

Research conducted by Suhartono, Didi, and Tika Sari in 2019 with the title "Comparison of Weighted Product Methods and TOPSIS in Determining Recipients of the Hopeful Family Program" resulted in an accuracy rate of 89.48% where the TOPSIS method was more suitable in case study selection, eligibility for PKH recipients [10].

3. PROCESS ANALYSIS

The system built is a decision support system in determining candidates for the competition. In simple terms, users can see various kinds of competitions (competitions in the field of IT, arts, etc.) along with the quota of participants, then they choose the competition according to their wishes, then the system will calculate the weighting using the Weighted Product (WP) method followed by the process of calculating the Technique for Order method. by Similarity to Ideal Solution (TOPSIS) to analyze the comparison of output and program
after passing a series of selections, be it a theory test, a practical test, and uploading supporting files to the system. The following are the processes that the system will perform:

3.1 Determination of competition
The system built will be able to accommodate various types of competitions and accommodate many criteria and student registrants with a predetermined participant quota.

3.2 Determination of criteria
The system built will be able to help provide recommendations for decision-making based on three main criteria, namely theoretical tests, practical tests, and supporting files.

<table>
<thead>
<tr>
<th>No</th>
<th>Type of Criteria</th>
<th>Example of Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Theory test</td>
<td>Written programming comprehension test</td>
</tr>
<tr>
<td>2</td>
<td>Practice test</td>
<td>Practice test presenting the work</td>
</tr>
<tr>
<td>3</td>
<td>Support Files</td>
<td>Uploading of a similar competition certificate</td>
</tr>
</tbody>
</table>

3.3 Determination of weight
The weights of the criteria for determining candidates for competition in this system use the level of importance in the form of a Likert scale in table 2.

<table>
<thead>
<tr>
<th>Name of Value</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very not important</td>
<td>1</td>
</tr>
<tr>
<td>Not important</td>
<td>2</td>
</tr>
<tr>
<td>Quite important</td>
<td>3</td>
</tr>
<tr>
<td>Important</td>
<td>4</td>
</tr>
<tr>
<td>Very important</td>
<td>5</td>
</tr>
</tbody>
</table>

3.4 Determination of parameter value
Some of the criteria used in this system are qualitative data, so to facilitate the calculation process it is necessary to classify the data criteria. However, because this case study system accommodates many fields of competition, to make testing and analysis easier, it is enough to do it in one race. One of the fields of competition that will be tested in this research is the IT field with the "Web Development Competition" which is taken from the standardized weight of the web programmer at PT. Cipta Harapan Samudera. The parameter value of each criterion can be seen in table 3.

<table>
<thead>
<tr>
<th>No</th>
<th>Criteria</th>
<th>Parameter</th>
<th>Type</th>
<th>Likert Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>$C_1$</td>
<td>Understand the concepts of HTML and CSS</td>
<td>Important</td>
<td>Theory</td>
<td>4</td>
</tr>
<tr>
<td>$C_2$</td>
<td>Mastering the programming language PHP, JavaScript, JQuery, and Ajax</td>
<td>Very important</td>
<td>Theory</td>
<td>5</td>
</tr>
<tr>
<td>$C_3$</td>
<td>Understand the use of the PHP framework</td>
<td>Quite important</td>
<td>Theory</td>
<td>3</td>
</tr>
<tr>
<td>$C_4$</td>
<td>Have good logic, analysis, and problem-solving</td>
<td>Important</td>
<td>Theory</td>
<td>4</td>
</tr>
<tr>
<td>$C_5$</td>
<td>Understand design software</td>
<td>Quite important</td>
<td>Theory</td>
<td>3</td>
</tr>
<tr>
<td>$C_6$</td>
<td>Mastering Object-Oriented Programming</td>
<td>Very important</td>
<td>Theory</td>
<td>5</td>
</tr>
<tr>
<td>$C_7$</td>
<td>Understand the concept of web hosting and domains</td>
<td>Quite important</td>
<td>Practice</td>
<td>3</td>
</tr>
<tr>
<td>$C_8$</td>
<td>Mastering MySQL database management</td>
<td>Very important</td>
<td>Theory</td>
<td>5</td>
</tr>
<tr>
<td>$C_9$</td>
<td>Understand the use of version control (GIT)</td>
<td>Important</td>
<td>Theory</td>
<td>4</td>
</tr>
<tr>
<td>$C_{10}$</td>
<td>Attach KHS about the value of web programming</td>
<td>Quite important</td>
<td>Support files</td>
<td>3</td>
</tr>
<tr>
<td>$C_{11}$</td>
<td>Award or certificate for those who have participated in similar competitions</td>
<td>Quite important</td>
<td>Support files</td>
<td>3</td>
</tr>
<tr>
<td>$C_{12}$</td>
<td>Able to</td>
<td>Important</td>
<td>Practice</td>
<td>4</td>
</tr>
</tbody>
</table>

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3.5 Accommodate attached files
If the criteria used to require an attachment file in the assessment, the system will receive an uploaded file from the enrolling student.

3.6 Calculation of alternatives according to the competition criteria
After the admin presses the calculate button, the system will calculate alternative recommendations for candidate participants according to the value per criteria entered by the admin including an assessment of the upload of the supporting files and a series of theoretical/practical tests.

3.7 Displays candidate recommendations
The system will normalize the weight and display the name of the participant's recommendation in a tab form, complete with ranking, method execution speed, announcement button, and analysis button.

3.8 Announcing the results to the student account
If the admin presses the "Announce" button, the system will continue the selection results which can automatically be seen on the account of each student registrant, precisely on the announcement menu.

4. MANUAL TESTING
In the manual calculation testing between the two methods, namely, WP and TOPSIS will be carried out to 7 student registrants who are given the same weight and value per criteria. The following are the scores per criteria given to the 7 alternatives.

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Criteria</th>
<th>Initial Weight</th>
<th>New Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hanenia Kumala</td>
<td></td>
<td>70 70 80 70 70</td>
<td>0.087</td>
</tr>
<tr>
<td>Asif Iskandar</td>
<td></td>
<td>80 80 80 90 70</td>
<td>0.1087</td>
</tr>
<tr>
<td>Rody Karnawan</td>
<td></td>
<td>60 70 80 70 70</td>
<td>0.0652</td>
</tr>
<tr>
<td>Muhadroddin</td>
<td></td>
<td>80 90 70 80 90</td>
<td>0.1087</td>
</tr>
<tr>
<td>Radhie Sibombing</td>
<td></td>
<td>70 90 70 50 80</td>
<td>0.0652</td>
</tr>
<tr>
<td>Hadie Pansi</td>
<td></td>
<td>60 50 70 80 70</td>
<td>0.087</td>
</tr>
<tr>
<td>Rocky Jusupit</td>
<td></td>
<td>60 60 70 70 70</td>
<td>0.0652</td>
</tr>
</tbody>
</table>

Figure 1: Alternative value per criteria.
Determine the vector value $S$

The vector value $S$, which can be calculated using the following formula:

$$S_i = \Pi_{j=1}^{n} (X_{ij}^{wj})$$

Raise and multiply the value of each alternative per criteria by the previously normalized weight.

$$S_1 = (X_{11}^{w1})(X_{12}^{w2})(X_{13}^{w3})(X_{14}^{w4})(X_{15}^{w5})(X_{16}^{w6})(X_{17}^{w7})$$

$$(X_{18}^{w8})(X_{19}^{w9})(X_{110}^{w10})(X_{111}^{w11})(X_{112}^{w12})$$

Becomes:

$$S_1 = (70^{0.087})(70^{0.1087})(60^{0.0652})(80^{0.087})(70^{0.0652})(80^{0.0652})(80^{0.0652})$$

$$= 71.12869217385$$

$$S_2 = (80^{0.087})(80^{0.1087})(70^{0.0652})(80^{0.087})(90^{0.0652})(70^{0.0652})$$

$$= 75.457915838002$$

$$S_3 = (60^{0.087})(70^{0.1087})(60^{0.0652})(80^{0.087})(90^{0.0652})(80^{0.0652})$$

$$= 69.255011534828$$

$$S_4 = (80^{0.087})(90^{0.1087})(70^{0.0652})(80^{0.087})(80^{0.0652})(90^{0.0652})$$

$$= 77.94601945666$$

$$S_5 = (70^{0.087})(90^{0.1087})(70^{0.0652})(80^{0.087})(50^{0.0652})(70^{0.0652})$$

$$= 72.711315265209$$

$$S_6 = (60^{0.087})(50^{0.1087})(70^{0.0652})(70^{0.087})(80^{0.0652})(70^{0.0652})$$

$$= 68.666704292828$$

$$S_7 = (80^{0.087})(60^{0.1087})(80^{0.0652})(70^{0.087})(60^{0.0652})(70^{0.087})$$

$$= 72.575296804507$$

Determine the vector value $V$

The vector value $V$ is to be used for ranking. The formula is as follows:

$$V_i = \frac{S_i}{\sum_{j=1}^{n} S_i}$$

Where the vector value $(V)$ is a choice that will be used in determining the ranking of each vector $S$ with the total vector value $S$

Simply put like:

$$V_i = \frac{S_i}{S_1 + S_2 + S_3 + S_4 + S_5 + S_6 + S_7}$$

Following are the results of calculating preferences $(V_i)$:

$$V_1 = \frac{71.1287}{71.1287 + 75.4579 + 69.255 + 77.946 + 72.7113 + 68.6667 + 72.5753} = \frac{71.1287}{504.3} = 0.140089$$

$$V_2 = \frac{75.4579}{71.1287 + 75.4579 + 69.255 + 77.946 + 72.7113 + 68.6667 + 72.5753} = \frac{75.4579}{504.3} = 0.148615$$

$$V_3 = 69.255$$

$$V_4 = \frac{77.946}{71.1287 + 75.4579 + 69.255 + 77.946 + 72.7113 + 68.6667 + 72.5753} = \frac{77.946}{504.3} = 0.153515$$

$$V_5 = 72.7113$$

$$V_6 = \frac{68.6667}{71.1287 + 75.4579 + 69.255 + 77.946 + 72.7113 + 68.6667 + 72.5753} = \frac{68.6667}{504.3} = 0.13524$$

$$V_7 = 72.5753$$

$$V_8 = \frac{72.5753}{71.1287 + 75.4579 + 69.255 + 77.946 + 72.7113 + 68.6667 + 72.5753} = \frac{72.5753}{504.3} = 0.142938$$
Finding the highest value from the calculation of the vector \( V \)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Alternative</th>
<th>Student Name</th>
<th>Vector S</th>
<th>Vector V</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A₁</td>
<td>Mutubaddan</td>
<td>77.946</td>
<td>0.153515</td>
</tr>
<tr>
<td>2</td>
<td>A₂</td>
<td>Arif Iskandar</td>
<td>75.4579</td>
<td>0.148615</td>
</tr>
<tr>
<td>3</td>
<td>A₃</td>
<td>Rodianto Sambong</td>
<td>72.7113</td>
<td>0.143206</td>
</tr>
<tr>
<td>4</td>
<td>A₄</td>
<td>Ricky Julaiet</td>
<td>72.5753</td>
<td>0.142938</td>
</tr>
<tr>
<td>5</td>
<td>A₅</td>
<td>Harista Kumala</td>
<td>71.1287</td>
<td>0.140089</td>
</tr>
<tr>
<td>6</td>
<td>A₆</td>
<td>Baby Kurniawan</td>
<td>69.2550</td>
<td>0.136398</td>
</tr>
<tr>
<td>7</td>
<td>A₇</td>
<td>Hafzie Panei</td>
<td>68.6667</td>
<td>0.13524</td>
</tr>
</tbody>
</table>

Figure 2: Result of weighted product decisions.

4.2 TOPSIS method

Normalization of the matrix. Matrix normalization is done by squaring each element of the matrix in figure 1, for example, cell \( A₁-C₁ \) squared to be \( 70 \times 70 = 4900 \) the results are as follows:

For example for row \( A₁ \) obtained from:

\[
A₁-C₁ = \frac{70}{\sqrt{56200}} = 0.368
\]

\[
A₁-C₂ = \frac{70}{\sqrt{58800}} = 0.357
\]

\[
A₁-C₃ = \frac{70}{\sqrt{58500}} = 0.329
\]

\[
A₁-C₄ = \frac{70}{\sqrt{58400}} = 0.399
\]

\[
A₁-C₅ = \frac{70}{\sqrt{58300}} = 0.35
\]

\[
A₁-C₆ = \frac{70}{\sqrt{58200}} = 0.412
\]

\[
A₁-C₇ = \frac{70}{\sqrt{58100}} = 0.278
\]

\[
A₁-C₈ = \frac{70}{\sqrt{58000}} = 0.406
\]

\[
A₁-C₉ = \frac{70}{\sqrt{57900}} = 0.32
\]

\[
A₁-C₁₀ = \frac{70}{\sqrt{57800}} = 0.384
\]

\[
A₁-C₁₁ = \frac{70}{\sqrt{57700}} = 0.382
\]

\[
A₁-C₁₂ = \frac{70}{\sqrt{57600}} = 0.369
\]

Normalization of weights.

Weighted normalization is obtained from the multiplication of the matrix in figure 4 (normalized matrix) with figure 3 (weight criteria), the results are as follows:

The total row (in blue) is obtained by adding up each row on each criterion. For example the total column \( C₁ \) is obtained from \( 4900 + 6400 + 3600 + 6400 + 4900 + 3600 + 6400 = 36200 \). After getting the total, then normalizing it by dividing each element of the matrix value figure 1 by the root (sqrt) of the corresponding total rows, the result is as follows:

![Figure 3: Value squared.](image-url)

![Figure 4: Normalized matrix.](image-url)
Positive/negative ideal solution distance
To find the total nd ranking, you must find the distance between the positive and negative ideal solutions obtained from the processing of figure 5 (weight normalization) and figure 6 (positive/negative ideal matrix). The trick is to square the difference between each element of the weighted normalized matrix and the ideal solution matrix, and then add up each alternative, after which it is rooted. For example, to find the positive ideal distance $A_1$ as follows:

$$A_1 = 1.145$$

Positive/negative ideal matrix.
The ideal solution matrix is obtained based on weighted normalization and the criteria attribute (cost or benefit). Since all criteria are of benefit, the ideal positive solution is the maximum value of weighted normalization. While the negative ideal solution is the minimum value of weighted normalization.

<table>
<thead>
<tr>
<th>Alternatif</th>
<th>Kriteria</th>
<th>$C_1$</th>
<th>$C_2$</th>
<th>$C_3$</th>
<th>$C_4$</th>
<th>$C_5$</th>
<th>$C_6$</th>
<th>$C_7$</th>
<th>$C_8$</th>
<th>$C_9$</th>
<th>$C_{10}$</th>
<th>$C_{11}$</th>
<th>$C_{12}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Haniya Kamala</td>
<td></td>
<td>1.476</td>
<td>1.848</td>
<td>1.594</td>
<td>1.106</td>
<td>1.015</td>
<td>1.055</td>
<td>1.201</td>
<td>1.150</td>
<td>1.146</td>
<td>1.148</td>
<td></td>
<td>1.148</td>
</tr>
<tr>
<td>Hadi Puspa</td>
<td></td>
<td>1.682</td>
<td>1.359</td>
<td>1.359</td>
<td>1.354</td>
<td>1.353</td>
<td>1.353</td>
<td>1.330</td>
<td>1.321</td>
<td>1.324</td>
<td>1.326</td>
<td>1.326</td>
<td>1.326</td>
</tr>
<tr>
<td>Risky Dedi</td>
<td></td>
<td>1.682</td>
<td>1.359</td>
<td>1.359</td>
<td>1.354</td>
<td>1.353</td>
<td>1.353</td>
<td>1.330</td>
<td>1.321</td>
<td>1.324</td>
<td>1.326</td>
<td>1.326</td>
<td>1.326</td>
</tr>
</tbody>
</table>

Positive/negative ideal matrix.
Preference is obtained from the ideal negative divider divided by the sum of the positive and negative ideal.

$$V_i = \frac{D_i}{D_i^+ + D_i^-}$$

The following is the result of the preference calculation ($V_i$):

$$V_1 = \frac{0.963}{1.145 + 0.963} = 0.4568$$

$$V_2 = \frac{0.893 + 1.306}{1.306} = 0.5189$$

$$V_3 = \frac{1.347 + 1.064}{1.557} = 0.4413$$

$$V_4 = \frac{0.672 + 1.557}{1.287} = 0.6725$$

$$V_5 = \frac{1.071 + 1.287}{0.808} = 1.462 + 0.808$$

$$V_6 = \frac{1.115}{1.14 + 1.115} = 0.4945$$

The best alternative is the one with the greatest preference. So that the ranking is as follows.
5. SYSTEM TESTING

Following are the results of the implementation and testing of data into the system by entering the same test data to meet the suitability of the data

6. COMPARATIVE ANALYSIS

Based on manual testing and system testing, a comparative analysis will be carried out at the following points:

1. Comparison of Euclidean Distance between the two methods
2. Comparison of calculation accuracy between systems with manual calculations
3. Comparison of program execution speed between the two methods

6.1 Euclidean Distance result

The comparative analysis uses the Euclidean Distance method to see which method is the most optimal in terms of the ranking priority averages of the two methods.

<table>
<thead>
<tr>
<th>Rank</th>
<th>Participant Recommendation</th>
<th>Vector S</th>
<th>Vector V</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Muhibuddin</td>
<td>77.946</td>
<td>0.153515</td>
</tr>
<tr>
<td>2</td>
<td>Arif Iskandar</td>
<td>75.4679</td>
<td>0.149615</td>
</tr>
<tr>
<td>3</td>
<td>Rudianto S</td>
<td>72.1113</td>
<td>0.143266</td>
</tr>
<tr>
<td>4</td>
<td>Ricky Jupiter Sipayung</td>
<td>72.6753</td>
<td>0.140293</td>
</tr>
<tr>
<td>5</td>
<td>Harista Kumala</td>
<td>71.1267</td>
<td>0.140906</td>
</tr>
<tr>
<td>6</td>
<td>Boby Kurniawan</td>
<td>69.2625</td>
<td>0.136938</td>
</tr>
<tr>
<td>7</td>
<td>Hadhe Panji</td>
<td>68.6667</td>
<td>0.13824</td>
</tr>
</tbody>
</table>

Muhibuddin: 0.1535
Arif Iskandar: 0.1486
Rudianto S: 0.1432
Ricky Jupiter: 0.1429
Harista Kumala: 0.1400
Boby Kurniawan: 0.1363
Hadhe Panji: 0.1352
Average: 0.14281

Table 5: Euclidean distance comparison analysis.
Based on the average results of the two methods used, it can be said that the Weighted Product method is the best because it has a value close to zero.

6.2 Comparison of calculation accuracy levels

In addition to the comparative analysis using Euclidean Distance, a comparative analysis of calculation accuracy is also used which is described as follows:

Table 6: Comparison result of calculation accuracy.

<table>
<thead>
<tr>
<th>Recommended Alternative</th>
<th>WP</th>
<th>TOPSIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A4</td>
<td>A4</td>
<td>A4</td>
</tr>
<tr>
<td>A2</td>
<td>A2</td>
<td>A2</td>
</tr>
<tr>
<td>A5</td>
<td>A5</td>
<td>A5</td>
</tr>
<tr>
<td>A7</td>
<td>A7</td>
<td>A7</td>
</tr>
<tr>
<td>A1</td>
<td>A1</td>
<td>A1</td>
</tr>
<tr>
<td>A3</td>
<td>A3</td>
<td>A3</td>
</tr>
<tr>
<td>A6</td>
<td>A6</td>
<td>A6</td>
</tr>
</tbody>
</table>

Testing of the WP method and the TOPSIS method is carried out to determine the recommendations of candidates for competition by using the following formula:

Accuracy = X / N x100%

Where:
N = number of data tested
X = number of correct data

TOPSIS method accuracy accuracy = X / N x 100% = 7/7 x 100% = 100%

Weighted Product (WP) method accuracy = X / N x 100% = 7/7 x 100% = 100%

6.3 Comparison of program execution speed

In addition to the comparative analysis of calculation accuracy, a comparative analysis of the execution speed of the PHP file was also carried out. The following table shows the results of the experiment execution time in the PHP program listing part of the calculation method of 10 trials in micro time/second

Table 7: Type and Example of Criteria.

<table>
<thead>
<tr>
<th>Trial</th>
<th>Speed (Micro time/Second)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>WP</td>
</tr>
<tr>
<td>1</td>
<td>0.074 second</td>
</tr>
</tbody>
</table>

Comparative analysis using Euclidean Distance shows that the WP method is the best in determining candidates for competition participants compared to the TOPSIS method. The total average time required for the WP method to execute the program is 0.0781 seconds while the total time required for the TOPSIS method to execute the program is

6.4 Difference from prior work

The difference between the results of the system and relevant research can be seen in the following table:

Table 7. Difference from prior work

<table>
<thead>
<tr>
<th>No.</th>
<th>Prior work</th>
<th>Our Research</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Agus Setyawan, Florentina Yuni Arini, and Isa Akhilis in 2017 entitled &quot;Comparative Analysis of Simple Additive Weighting Methods and Weighted Product Methods Against the New Employee Recruitment Decision Support System (DSS) at PT. Warta Media Nusantara &quot;, the test results show that the average execution time of the SAW method is</td>
<td>Comparative analysis using Euclidean Distance shows that the WP method is the best in determining candidates for competition participants compared to the TOPSIS method. The total average time required for the WP method to execute the program is 0.0781 seconds while the total time required for the TOPSIS method to execute the program is</td>
</tr>
</tbody>
</table>
1. Comparative analysis using Euclidean Distance shows that the WP method is the best in determining candidates for competition participants compared to the TOPSIS method.
2. The total average time required for the WP method to execute the program is 0.0781 seconds while the total time required for the TOPSIS method to execute the program is 0.2234 seconds.
3. The level of accuracy of the system calculation with manual calculations on the WP method and the TOPSIS method in determining the candidate for competition reaches 100%.
4. This system can assist the campus in determining candidate recommendations according to the competition criteria.
5. The ranking results produced by the WP method and the TOPSIS method have the same ranking order.
6. This system is only a tool for a decision support system for determining candidates for competition, the final decision remains in the hands of the decision-maker.

REFERENCES:


