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Comparison of Moora, Waspas and SAW Methods in Decision Support Systems

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ABSTRACT

Education is a process in the framework that can adapt to the environment and thus will cause changes in themselves that enable it to involve all that is in society. In this case, the process of selecting the best teachers and staff in data processing is still done manually by conducting tests through several criteria that have been made. Criteria used for the process. There are 19 criteria. The selection process carried out manually has several weaknesses so that it will result in errors in data processing. For this reason, a Decision Support System is needed that can be used in the process of selecting the best Teachers and Staff. In this study, using the calculation method calculation methods Moora, SAW, and WASPAS with scholarship recipients. The results obtained from the Moora Method are 3 (three) highest values at V1 = 1.89; V8 = 1.81; and V2 = 1.80, the SAW Method was 3 (three) highest values at V1 = 10.38; V8 = 9.90; and V2 = 9.87. The WASPAS method that 3 is highest at V1 = 5.07; V8 = 4.72; and V2 = 4.68. The system created using the SAW method because it provides the Best Alternative value and provides the best ranking results

1. Introduction

The teacher and staff selection process is a very important stage for the progress of a school agency. In this selection process, accuracy and accuracy are needed because it affects the quality of human resources within the school. The selection process is done manually and has not been computerized. The selection process done manually has several disadvantages, having large errors in the data processing process[1], [2].

In implementing decision support systems, many methods or methods have been used, such as the Simple Additive Weighting (SAW) Method, Multi-Objective Optimization by Ratio Analysis (MOORA), and the Weighted Aggregated Sum Product Assessment (WASPAS) Method.

Previous studies have researched determining the best teachers using the Moora and SAW methods. Whereby combining the two methods produces maximum value in the selection process [1].

2. Related Work

This paper presents an approach that aims to build a decision support system dedicated to analyzing the organizational performance of the risk management unit. This is based on a systemic approach through the following steps: observations to limit the system and its interactions, static modeling to describe the system formally according to certain standards, identification of indicators to focus on weak points and unit strengths, and dynamic modeling using multi-agent systems to simulate technical ins and outs of the learning system [3].

The case study of this research on the deep climate in the living room and comparative analysis of data obtained with values provided by hygienic norms makes it possible to state that most of the parameters investigated do not meet current specifications. Forced ventilation must be installed in this living room to ensure the required level of air turnover. Evaluation data obtained using the MOORA method can be used in determining the market value of certain apartments or flats in Lithuania as well as in other countries [4].

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Seaport planning simulations are limited in their application. Of course, if the simulation has no practical consequences, in any case, it provides learning experience with MOORA in its dual composition. Conflicts can arise between local, national authorities and between the protagonists for more commercial ports and those that are more industrial. Finally, more and more port planning must consider ecological conditions. In other words, port planning is related to many destinations but most are expressed in different units, which means normalization problems. Also, port planning seeks to achieve optimization. To break away from the subjectivity of traditional multi-purpose methods, a ratio system, under the name MOORA, was developed, where normalization was not needed. Using MOORA, the min-max matrix with a Reference Point forms the second approach to test the first result [5].

In this article in the Modification of Fuzzy Transportation Algorithm (FTA) to find the optimal fuzzy solution and the minimum fuzzy transportation costs for Full Fuzzy Transportation. Problems (FFTP) where each fuzzy transportation cost is converted to crisp transportation costs using the Ranking Ranking Method (RSM) multiplied by the weight generated using the Simple Additive Weighting (SAW) method. The proposed modification of the Algorithm is very easy to understand and realistically applies to complete the FFTP in real life situations for decision-makers [6].

Fuzzy logic is one example of the most useful methods to help in making decisions in a scientific, objective way and to limit subjective factors. This article introduces the SAW method and the GRA method for assessing student competency. This method is widely used for multi-criteria evaluation. Although they may appear different, both methods have many common features and properties. The general nature of the two methods is that it is possible in a comparison and evaluation criteria to describe hierarchically structured complex magnitudes, which have the same hierarchy of levels. The results obtained have different data, produced by the other multi-criteria evaluation method explained when the same data set uses two methods. there is an illustration that is obtained is the difference between the two methods for the process of normalization and calculating the value of alternatives and properties [7].

In this paper, eight illustrative examples of real-time manufacturing environments are solved using the WSAS method, which is a combination of two popular MBM methods, e.g. WSM and WPM techniques. It has been proven that the accuracy of an aggregate method will always be better than a single method. For all eight considered selection problems, it was observed that the WASPAS method provides an almost accurate ranking of alternative candidates compared to previously obtained researchers. The effect of parameters on the ranking performance of the WSAS method is also studying, revealing the fact that better performance is obtained at a higher value. The value is set at 0, the WASPAS method behaves like the aWPM method, and when 1, it is transformed into the WSM method. The main advantage of this method was identified as his strong resistance to ranking reversals from the alternatives considered. It was also found that this method has the unique ability to handle single and multi-response optimization problems in various machine operations. Because this method involves simple and healthy mathematics, and its nature is quite comprehensive, this method can be applied successfully for any manufacturing decision-making situation [8].

Increased population welfare and income lead to the need for new construction sites. Choosing the best location for a new construction site in a fuzzy environment becomes a difficult task for stakeholders. This paper proposes a combined fuzzy MADM approach to the AHP and WASPAS-F fuzzy methods to select suitable construction site locations. In the proposed method, fuzzy AHP is used to determine the attribute weights, while WASPAS-F is used to rank alternative locations. His approach combines the strong sides of the AHP and WASPAS methods. As a result of the study, we found that the proposed practical method for ranking alternatives concerning several conflicting attributes for large scale problems [9].

3. Method

3.1 Research Model Concept

This research was conducted using qualitative research which is often called the naturalistic research method because the research was carried out using natural conditions by understanding and describing existing problems based on facts and data available.

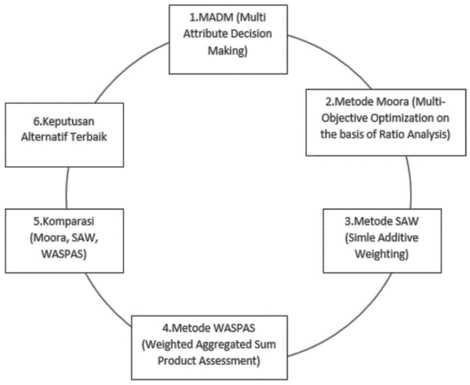

Fig 1. Research Method

3.2 Moora Method

Multi-criteria analysis and solution methodology are presented, which include inadequate knowledge from decision-makers and other pressures involved in evaluation with the help of an extension of the MOORA (Multi-Purpose Optimization based Ratio Analysis) ratio system approach in this study. The method in the study entitled Extension of the MOORA Approach for Decision Making Groups based on Intervals valued Intuitive fuzzy numbers in digital supply chains uses intervals valued at intuitionistic fuzzy numbers and group decision making approaches, which are shown in real case studies to demonstrate the validity of the proposed approach for supplier selection appropriate in DSC [10].

In this research the Application Method with the MOORA method for parametric optimization of the grinding process is only based on analyzing ratios simply, involving the least amount of mathematics, which may be very useful and beneficial for decision-makers who may not have a strong background in mathematics. Also, the calculation time for the MOORA method will be lacking. In all cases, it was observed that occupying the top of the alternatives matched exactly what was revealed by previous researchers who proved the applicability, potential, and flexibility of this method.The MOORA method consists of four main steps [1], [2], [10]–[14] , as follows

Step 1:

The first step to be taken is to determine the direction of the goal and identify the attributes of the evaluation in question

Step 2:

Shows all available information for attributes so that they can form a matrix in a decision. Data given by equation 1 is represented as a matrix x. where Xij represents the I measure of the alternatives to the j attribute, m represents the number of alternatives and n indicates the number of attributes. Then the ratio system is developed for each result of an alternative compared to a denominator that represents all alternatives regarding these attributes.

$$X = \begin{bmatrix} X11 & X12 & \cdot & X1N \\ X21 & X22 & \cdot & X2N \\ \vdots & \vdots & & \vdots \\ XM1 & XM2 & . & XMN \end{bmatrix} \quad (1)$$

Step 3 :

The best choice of the square root of the sum of the squares of each alternative per attribute. This ratio can be stated as follows.

$$Xij = \frac{xij}{\sqrt{\sum_{j=1}^{m} x_{ij}^2}} \quad (2)$$

Where Xij is the dimension value at which has an interval [0,1] the normalized results of alternative i on the j attribute are presented

Step 4 :

for multi-objective optimization, the result of normalization is the sum in terms of maximization (of beneficial attributes) and reduction in terms of minimization (of attributes that are not profita ble. Next, the optimization problem becomes:

$$Yi = \sum_{j=1}^{g} xij - \sum_{j=g+1}^{n} Xij \quad (3)$$

Where g is the value of the criterion to be maximized, (n-g) is the value of the criteria to be minimized, and Yi is the value of the alternative normalization assessment of all attributes. In some cases, often observe several other more important criteria. order to give more important attributes, it is carried out with appropriate weights (significant coefficient). When the weights of this criterion are taken into consideration, the Yi equation is as follows

$$Yi = \sum_{j=1}^{g} WjXij - \sum_{j=g+1}^{n} WjXij \quad (4)$$

Where Wj is the attribute weight j.

3.3 SAW Method

The Simple Additive Weighting (SAW) method is often also known as the method of weighting. The concept carried out by the SAW method is to find a sum weighted from the existing performance rating of each alternative on all attributes. The SAW method makes decisions by determining the weights for each attribute.

This paper entitled Combining Fuzzy Set - Simple Additive Weight and Comparing With Gray Relational Analysis For Student's Competency Assessment In The Industrial 4.0 takes an integrated approach to do a combination of fuzzy set theory and simple additives with the weight method (SAW) in terms of the competence of assessment students. These results indicate better sensitivity, specificity, this compared to gray relational analysis (GRA) [7].

Through a study entitled Applying fuzzy simple additive weighting system to health examination location selection institutions, FSAWS is a result of profit criteria, and also gets satisfying results for HEI in the choice of a location problem. The FSA WS can be used in the problem-solving process in selecting the location of a facility. Furthermore, because it is done according to ergonomic design rules, the FSA WS can be done in matters of management decisions, for example, the selection of personnel, supplier problems, and project management [15].

The steps to use the SAW method are as follows [6], [7], [15]–[17]:

$$Rij = \begin{cases} \frac{x_{ij}}{Max\ x_{ij}} & If\ j\ Atributes\ Benefit \\ \frac{Min\ x_{ij}}{x_{ij}} & If\ J\ Atributes\ Cos \end{cases} \quad (5)$$

With Rij is a normalized performance rating of Ai alternatives in attributes Cj; i =1,2,...m and j = 1,2,...,n.

$$V_i = \sum_{j=1}^{n} W_j R_{ij} \quad (6)$$

3.4 WASPAS Method

In a study entitled A Multi-Objective Approach With WASPAS Decision-Making for Workflow Scheduling in Cloud Environment selects the optimal solution from the Pareto optimal circuit with the needs desired by the user is the WASPAS method. in the simulation results in this study, the SPEA2 and NSGA2 algorithms in the level of diversity in the black hole algorithm have an unbalanced workload [18].

In a study entitled Implementation of the Weighted Aggregated Sum Product Assessment Method in Determining the Best Rice for Pancake Cake Making as for the steps used to determine the best rice and used early in making pancake cakes using the Weighted Aggregate Product Number Assessment method, ie Prepare a matrix which is a the value of each set of criteria, normalizing the x matrix data to be normalized, and calculating the value of the alternatives using the Weighted Aggregate Product Estimation formula so that the rating value is found. After this step was carried out, this research is the best rice that is suitable for use as a material for making pancake is Pelita rice with the value obtained 7.12 with the highest rice supply position[19].

The WASPAS method is a method used to find the value with the most appropriate priority using the weighted method. This WASPAS method is a combination of two sources known as the MCDM approach, WMM and the heavy product model (WPM) in the linear normalization process of the result element required. Using the WASPAS method, the optimal combination criteria are searched using two optimal criteria. The first criterion is called optimal, good average criteria are the same as the WSM method. This

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option is a popular MCDM and is used in decision making. The working steps of the WASPAS Estimation method are [8], [9], [18], [19]:

Step 1:

Prepare a Matrix

$$X=\begin{bmatrix} X11 & X12 & \cdot & X1N \\ X21 & X22 & \cdot & X2N \\ \cdot & \cdot & \cdot & \cdot \\ XM1 & XM2 & \cdot & XMN \end{bmatrix} \quad (7)$$

Based on formula (7), m is the number of alternative candidates, n is the number of evaluation criteria and x is the alternative performance with respect to criteria j

Step 2 :

Normalize the value of Xij with the following formula (3) and (4) :

Benefit Criteria

$$Xij=\frac{Xij}{MaxiXij} \quad (8)$$

Cost Criteria

$$Xij=\frac{Mini\ Xij}{Xij} \quad (9)$$

Step 3 :

$$Q=0,5\sum_{j=1}^{n}\bar{X}_{i}ijWj+0,5\prod\left(\bar{X}_{i}ij\right)Wj \quad (10)$$

The best value of Q is the highest value

4. Result

4.1 Criteria

The initial stage is first to analyze the fatherly criteria as the beginning of the selection process. Therefore the criteria used 19 criteria support the selection process. The criteria can be seen in Table I along with the weight value of the respective criteria.

Table 1

Table Criteria

Criteria Code	**Criteria**	**Attribute**	**Weight**
C1	Common Sense	The Profit	0.50
C2	Verbalization of Ideas	The Profit	0.50
C3	Systematic Thinking	The Profit	0.62
C4	Reasoning and Real Solutions	The Profit	0.53
C5	Concentration	The Profit	0.50
C6	Practical Logic	The Profit	0.60
C7	Flexibility of Thinking	The Profit	0.50
C8	Creative Imagination	The Profit	0.50
C9	Anticipation	The Profit	0.52
C10	Potential Intelligence	The Profit	0.60
C11	Psychic Energy	The Profit	0.50
C12	Accuracy and Responsibility	The Profit	0.50
C13	Caution, Control of Feelings	The Profit	0.52
C14	Impulse Achievement	The Profit	0.57
C15	Vitality and Planning	The Profit	0.52
C16	Dominance	The Profit	0.50
C17	Influence	The Profit	0.52
C18	Steadiness	The Profit	0.50
C19	Compliance	The Profit	0.50

4.2 Match Rating

Based on the criteria and weighting data above, the next step gives the value of each alternative. The values for the selection are in Table 2.

Table 2
Selection Table

	C1	***C2***	***C3***	***C4***	***C5***	***C6***	***C7***	***C8***	***C9***	***C10***	***C11***	***C12***	***C13***	***C14***	***C15***	***C16***	***C17***	***C18***	***C19***
A1	90	95	90	95	95	85	90	90	90	90	95	90	90	95	85	85	95	90	95
A2	90	90	80	90	90	85	85	80	85	90	90	85	90	80	90	85	90	85	90
A3	80	80	90	90	80	80	90	80	90	85	80	85	85	80	80	90	80	85	90
A4	90	85	90	90	80	80	80	80	90	85	85	90	80	85	85	80	95	80	90
A5	80	85	80	75	80	80	89	85	80	89	85	88	80	87	86	85	88	89	80
A6	89	70	80	83	84	84	85	84	80	85	87	87	87	90	87	80	85	85	85
A7	89	80	80	85	80	95	80	85	86	87	85	80	85	89	88	89	85	86	88
A8	80	88	87	85	88	89	88	87	86	86	84	95	87	86	90	90	89	85	86
A9	90	86	87	88	90	85	86	78	89	87	84	86	89	89	88	82	80	82	82
A10	89	70	75	86	85	84	88	86	90	70	79	70	90	87	87	86	86	85	80
A11	80	85	88	86	90	79	78	80	85	90	76	75	75	80	75	80	88	89	85
A12	89	89	80	88	85	80	86	87	88	87	86	85	80	79	75	75	80	78	90
A13	76	76	87	90	75	80	79	75	88	88	83	89	85	86	87	80	89	90	95
A14	77	78	76	80	90	76	76	80	85	86	87	88	90	76	79	77	78	72	90
A15	92	88	87	86	85	79	70	90	85	84	88	75	80	86	88	79	89	87	87
A16	86	87	87	87	90	87	79	74	72	76	70	95	86	75	80	86	80	77	89
A17	76	76	70	76	78	77	73	76	97	90	87	82	83	83	79	80	85	86	88
A18	89	76	75	70	83	82	80	88	86	87	70	75	76	76	90	81	87	86	87
A19	87	89	88	87	86	86	89	88	85	70	70	75	89	77	77	78	75	78	96
A20	78	77	79	80	85	89	87	88	89	85	87	90	77	75	79	90	87	81	80
A21	78	82	84	86	90	78	85	83	81	76	80	75	80	82	89	88	87	86	89
A22	76	80	90	91	75	72	89	85	79	87	86	78	79	85	84	86	81	85	79
A23	86	79	76	95	89	80	86	88	76	75	70	85	84	80	87	86	85	86	90
A24	78	79	83	78	85	90	60	75	80	78	95	76	80	85	86	80	87	81	75

4.3 Comparison of The Moora, SAW, and WASPAS Method

Comparison of the Moora, SAW, and WASPAS methods from the results of the calculation analysis as in table 3.

Table 3
Comparison Moora Method, Saw, And Waspas

Rank	Moora		SAW		WASPAS	
1	V1	1,89	V1	10,38	V1	5,07
2	V8	1,81	V8	9,90	V8	4,72
3	V2	1,80	V2	9,87	V2	4,68
4	V4	1,78	V4	9,73	V9	4,60
5	V9	1,78	V9	9,71	V4	4,60
6	V7	1,77	V3	9,61	V7	4,57
7	V5	1,76	V7	9,61	V15	4,53
8	V15	1,76	V5	9,59	V3	4,50
9	V13	1,76	V13	9,58	V13	4,49
10	V3	1,76	V6	9,56	V5	4,48
11	V6	1,75	V15	9,56	V6	4,47
12	V12	1,73	V21	9,50	V12	4,45

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Rank	Moora		SAW		WASPAS	
13	V22	1,73	V12	9,49	V20	4,44
14	V20	1,73	V23	9,49	V21	4,42
15	V21	1,72	V22	9,48	V23	4,41
16	V23	1,71	V20	9,47	V22	4,40
17	V10	1,71	V10	9,44	V11	4,39
18	V11	1,71	V11	9,38	V10	4,36
19	V17	1,70	V19	9,36	V19	4,35
20	V19	1,70	V16	9,28	V16	4,33
21	V18	1,70	V18	9,25	V18	4,30
22	V16	1,69	V17	9,20	V17	4,27
23	V14	1,68	V14	9,18	V14	4,25
24	V24	1,66	V24	9,00	V24	4,24

4.4 Comparative Diagram Of The MOORA, SAW, And WASPAS Method

From the Comparison table of the Moora, SAW, and WASPAS methods as in table III. A comparative diagram can be made as in Figure 2.

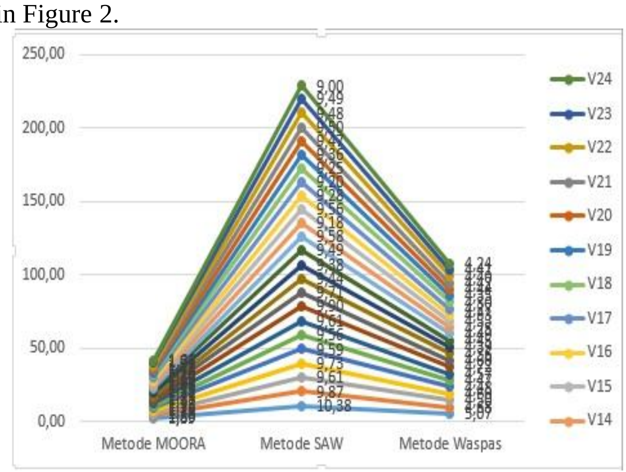

Fig 2. Table Comparative

5. Conclusion

In this study entitled the comparison of Moora, SAW, and WASPAS at SMPN 1 Palipi by using the calculation calculation calculation using the SAW method because the results of the analysis of the SAW method calculation obtained the highest preference value with a value of V1 = 10.38 from the Waspas Method with a value of V1 = 5.07 and the WASPAS Method are higher than the Moora method with a preference value of V1 = 1.89 which can be seen in table IX.

The results of the above research can be obtained that in the end obtained different values from each of the values that have been obtained. The results obtained on the Moora method are the value of alternative 1 gets a value of 9.95, the second alternative gets a value of 9.50, the third alternative gets a value of 9.20, and the fourth alternative is 9.31. While the results obtained from the method of Moora and saw namely at alternative 1 get a value of 0.524, the second alternative gets a value of 0.473, the third alternative gets a value of 0.476, and the fourth alternative gets a value of 0.478. From the value obtained that the highest to lowest value in the Moora method is obtained from Alternative 1, Alternative 2, Alternative 4, and Alternative 3. The value obtained from the combination of Moora and Saw methods is that the first alternative gets a value of 0.524, the second alternative gets a value of 0.473, the third alternative gets a value of 0.476, and the fourth alternative gets a value of 0.478. From the merging of Moora and saw can be sorted alternative from the highest and lowest are alternative 1, alternative 4, alternative 3, and alternative 2.

It can be seen that by using the hybrid method the SAW and MOORA get a good decision. The result is that in alternative 1 (V1) has a value of 0.524 and is ranked first, after that alternative 4 (V4) is ranked second with a value of 0.478 alternative 3 (V3) is the third rank with a value of 0.476, and alternative to 2

(V2) is ranked fourth with a value of 0.473. With this method, it can be easier for schools to select teachers in junior high schools.

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