

Implementation of The Multi-Attribute Utility Theory Method in Determining the Best Work on The Yuwana Wikimedia Project

Muhammad Ikhlas*¹, Rio Bayu Sentosa²

¹Teknik Informatika, Fakultas Ilmu Komputer, Universitas Putra Indonesia YPTK

²Sistem Informasi, Fakultas Ilmu Komputer, Universitas Putra Indonesia YPTK

e-mail: *mhdikhlask@upi.ptk.ac.id, riobayusentosa@upi.ptk.ac.id

Abstract

Reading activities are a form of literacy that can foster societal development. We can encounter various short forms of literacy besides reading and writing books, such as novel reviews, communicating, and cross-talking. “However, there is still limited access to platforms that support literacy activities, particularly those that encourage community storytelling”. The Yuwana Project is one of the competitions held by Wikimedia Indonesia to provide space for people to work on writing children's short stories and traditional game stories. This competition is held online via Wikibuku. Where participants who take part in this competition will be assessed to determine the best work. The assessment process needs to be thorough so that those assessed comply with the assessment criteria that have been determined. For this reason, there is a need for a method that can produce the best decisions. The Multi-Attribute Utility Theory (MAUT) method is a method for making decisions by identifying and analyzing several variables quantitatively. In this study, 10 alternative data were tested, where the results were A6 with a preference value of 0.65 with the best first rank, then A7 with a preference value of 0.62 ranked second, and A2 with a preference value of 0.60 ranked third. So that the MAUT method can provide recommendations for selecting the best work for the Yuwana Wikimedia project.

Keywords— MAUT, Yuwana, Decision Support System

1. INTRODUCTION

Current social life makes reading and writing literacy a very important part. Literacy ability is one of the human rights that must be facilitated because literacy makes people able to communicate in a literate society. Several opinions state that the process of improving the quality of literacy can be done in various ways, one of which is by using ICT (Information and Communication Technology) [1]. Without technology, many aspects of life would be more difficult, less efficient, and limited. Information technology is a medium that can be used to obtain and process data and can then be stored and manipulated to produce quality, relevant, accurate, and timely information for personal and group needs [2]. Technology, especially in decision-making systems, will have an impact on these changes, such as increasing the efficiency of decision-making, increasing the quality of decisions, and reducing human error.

Wikimedia Indonesia, through the Yuwana Project, is holding a children's short story writing competition and a catalog of traditional games through Indonesian Wikibooks. With this competition, Indonesian Wikibooks can be used as a source of knowledge that is useful for various groups. The assessment of this competition is divided into two categories, namely children's short stories and traditional game catalogs where each instrument or category has different assessment criteria [3]. So there needs to be a good quantitative method used to produce the right decisions to produce the winner of the Yuwana project competition.

One decision-making method that can be used is Multi-Attribute Utility Theory

(MAUT) [4]. MAUT is a decision-making method using many criteria called Multi-Criteria Decision Making (MCDM), where MAUT uses a final evaluation scheme, $v(x)$ from several objects and then adds the weights defined as x with a value that is related or relevant. On utility value (dimensional) [5]. MAUT method functions to replace several interests in the form of numerical numbers on a scale of 0-1, where 0 is the quickest choice and 1 is the best choice [6]. MAUT method allows quantitative comparisons by combining different measurements of risk costs and benefits so that it can provide output to support decisions based on calculations [7]. The right decision-making method will help decision-makers in making decisions, both in semi-structured and unstructured conditions [8]. By analyzing all solutions to select the appropriate alternative, this can of course be done with a multi-criteria decision aid methodology such as MAUT [9].

Several previous studies that have applied the MAUT method in decision-making include research on employee performance appraisals where the results can be used as consideration for related agencies in determining employee performance [10]. Next is research on determining the suitability of nursery land [11]. Then there is research on determining outstanding students [12]. In this research, the MAUT method was used to solve decision-making problems, where the research results provided the right decisions based on the criteria.

Based on the problems above and referring to the MAUT method, this method is relevant and can provide decision results in the form of recommendations for the choice of winners for the Yuawan Wikibuku Indonesian project competition more objectively based on the criteria contained in the discussion of this research.

2. RESEARCH METHODS

The framework that will be followed in this research can be seen in Figure 1:

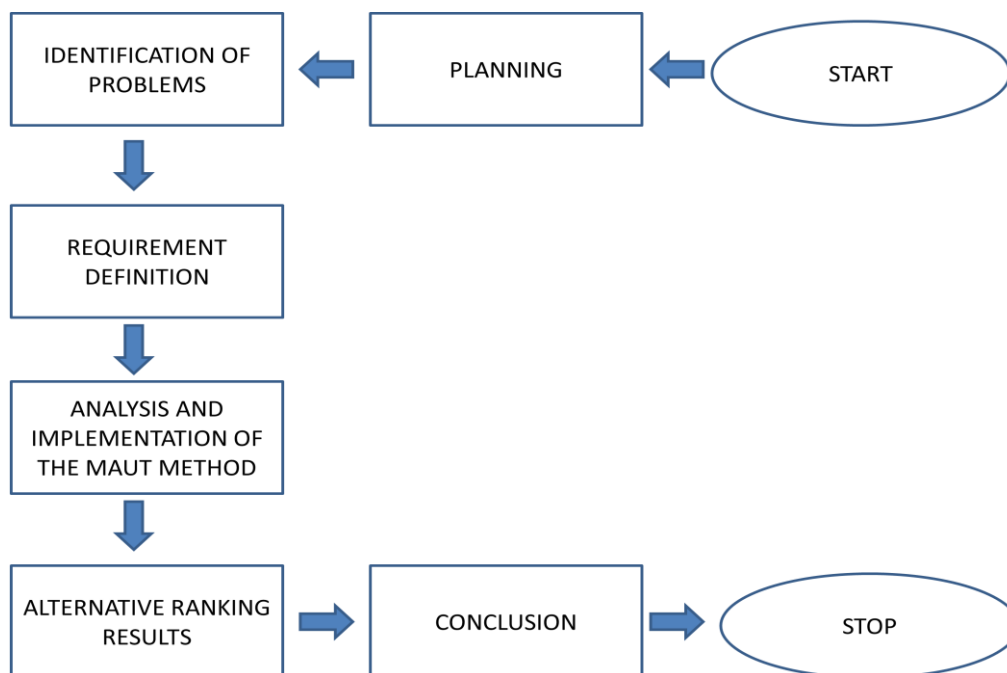


Figure 1. Research framework

Following is a description of the framework :

1. Planning

Planning is an activity in determining the research plan to be implemented, the research framework starting from the research proposal including the research budget and schedule,

background and methods used in the research, research implementation and research outputs that will be produced.

2. Identification of Problem

Identification of the problem is a stage carried out to define what problem will be researched so that it is more measurable.

3. Requirement Definition

At this stage, each problem that has been identified and defined is then collected data that is relevant to the problem to be studied. Data collection was carried out using non-participant observation and document studies. Available data information can be accessed through the Wikibuku page [3]. On the page, there is a background to this competition, competition rules, and what criteria are assessed in the process of determining the winner of the competition. The author uses literature study in the data collection process. The data collection process in this research uses content analysis techniques. This research method uses text, visualization, or other forms of communication to analyze and interpret the meaning of content. The source of the data analyzed comes from the Wikibuku site with the URL address https://id.wikibooks.org/wiki/Kategori:Cerita_pendek [13]. The content contained in the site comes from the participants of the Yuwana Project competition. The total population of data on the site is 47 story manuscripts, where 39 story manuscripts are included in the main category, namely short stories, 7 story manuscripts are included in the subcategory, namely children's short stories, and 1 story manuscript is included in the subcategory of short story reviews. The content of the short story manuscripts from this study is summarized in the following document bit.ly/Table_of_contents_Wikibooks. In this research, the author randomly took 10 manuscript samples from a total of 47 manuscripts which were used as alternatives and then analyzed. The total population of data in this category is 47 story manuscripts, of which 39 story manuscripts are in the main category, 7 story manuscripts are in the children's short story subcategory and 1 story manuscript is in the short story review subcategory. In this research, the author carried out simulations on short story data from 10 samples from a total of 47 populations which were then used as alternatives.

4. Analysis and Application of the MAUT Method

Study documents that have been collected then the next step is to analyze the data to determine what components or criteria are needed and the weight of each criterion assessment which is then compared with alternatives using the MAUT method. This method requires quantitative determination of weights as assessment criteria to assess the level of importance of each criterion [14]. The results of choices are based on analysis and calculations using this method, then recommendations are made in the form of rankings [15].

5. Conclusion

At this stage, the winner of the Yuwana competition is determined based on the ranking results that have been processed previously using the MAUT method, so that the results provided can support the decision of the assessment board regarding the winner of the competition.

3. RESULT AND DISCUSSION

The implementation of the MAUT method in the process of determining the best work for the Yuwana project begins by first defining what alternatives are involved in the competition and outlining the assessment criteria and the value of each of these criteria. The second stage is to classify all alternatives for each criterion separately. The criteria determined in the competition assessment consist of foreword components, intrinsic elements, extrinsic elements, visual illustrations, originality of work, balance of proportions of ideas and writing techniques,

neatness and layout, and also language style [3]. The third stage is that each criterion is given a relative weight. The fourth stage is the relative weight of each criterion and the evaluation results based on all alternatives combined to obtain a total evaluation of all alternatives. Lastly, make recommendations based on the results of a total evaluation of all alternatives [16].

1. Determine Alternatives, Criteria Data and Weights

In determining the alternatives, there are ten data processed as testing. Then in the assessment of short story works from the Yuwana project competition held by Wikimedia Indonesia, there are eight assessment criteria with each criterion having a weight presentation taken from the assessment factor document provided by Wikimedia in Wikibuku about the Yuwana project. As follows [3] :

Table 1. Criteria and Weight of Each Criteria

No	Name of Criteria	Code	Value (%)	Weight
1	Foreword Components	C1	5%	0.05
2	Intrinsic Elements	C2	25%	0.25
3	Extrinsic Elements	C3	5%	0.05
4	Visual Illustrations	C4	20%	0.20
5	Originality of Work	C5	10%	0.10
6	Balance of Proportions of Ideas and Writing Techniques	C6	20%	0.20
7	Neatness and Layout	C7	5%	0.05
8	Language Style	C8	10%	0.10
Total			100%	1.00

In determining the assessment criteria above, each short story will be assessed based on the components, namely each children's short story must begin with an introduction, in the introduction contains general author data and the premise of the story which generally consists of one or two short sentences that contain the idea of the story, the weight of this component is 5%. So children's short stories must contain intrinsic elements as story builders and extrinsic elements in the form of background skills and there are social, moral, cultural, or religious values. Where intrinsic elements have a weight of 25% and extrinsic elements 5%. The next component is that there are visual illustrations that support the contents of the story with a weight of 20%. So the work must be original, not a translation, not an adaptation, and not plagiarism with an assessment weight of 10%. The proportion of ideas and writing techniques must be balanced with a weight of 20%. Neatness and layout weight 5%, and language style with a weight of 10% [3].

2. Forming a Decision Matrix

In calculating the level of importance or assessment of each alternative based on existing criteria, namely by using a rating scale of 1 – 10 where the smallest value has a very bad value to the largest value is very [17]. The following is a simulation of alternative data on 10 samples from a total of 47 contents taken randomly, then create a table of match values with each criterion.

Table 2. Alternative Value of Each Criteria

No	Alternative	Criterion Name							
		C1	C2	C3	C4	C5	C6	C7	C8
1	A1	8	8	7	6	6	8	9	6
2	A2	7	8	7	5	8	6	6	8
3	A3	9	8	6	7	6	7	7	9
4	A4	6	6	8	7	6	6	5	8
5	A5	6	6	8	6	8	6	7	7
6	A6	7	7	8	6	8	8	7	8
7	A7	8	7	7	7	6	8	8	8
8	A8	7	9	7	8	6	6	7	7
9	A9	7	5	8	7	8	6	7	7
10	A10	8	7	7	8	6	6	7	8

Minimum	6	5	6	5	6	6	5	3
Maximum	9	9	8	8	8	8	9	9

3. Decision Matrix Normalization

In the normalization process, each alternative based on existing utility functions can be used to find the evaluation results of the xth alternative, which is also known as $U(x)$, following is equation (1) [18]:

$$U(x) = \frac{x - x_i^-}{x_i^+ - x_i^-} \quad (1)$$

Where:

$U(x)$ = Utility value of alternative to $-x$

x_i^- = Minimum value from x_i

x_i^+ = Maximum value from x_i

Normalization is an important step that aims to change the original values of each alternative into the same scale. This is necessary because each attribute or criterion in the decision-making process often has a different scale, ensuring consistency, simplifying calculations, and normalization helps avoid bias in evaluating alternatives.

The following is the normalization process for each alternative based on the functions of each utility using equations (1) :

a. Alternative 1 (A1)

$$A1_1 = \frac{8 - 6}{9 - 6} = 0.67$$

$$A1_5 = \frac{6 - 6}{8 - 6} = 0.00$$

$$A1_2 = \frac{8 - 5}{9 - 5} = 0.75$$

$$A1_6 = \frac{8 - 6}{8 - 6} = 1.00$$

$$A1_3 = \frac{7 - 6}{8 - 6} = 0.50$$

$$A1_7 = \frac{9 - 5}{9 - 5} = 1.00$$

$$A1_4 = \frac{6 - 5}{8 - 5} = 0.33$$

$$A1_8 = \frac{6 - 6}{9 - 6} = 0.00$$

b. Alternative 2 (A2)

$$A2_1 = \frac{7 - 6}{9 - 6} = 0.33$$

$$A2_5 = \frac{8 - 6}{8 - 6} = 1.00$$

$$A2_2 = \frac{8 - 5}{9 - 5} = 0.75$$

$$A2_6 = \frac{6 - 6}{8 - 6} = 0.00$$

$$A2_3 = \frac{7 - 6}{8 - 6} = 0.50$$

$$A2_7 = \frac{6 - 5}{9 - 5} = 0.25$$

$$A2_4 = \frac{5 - 5}{8 - 5} = 0.00$$

$$A2_8 = \frac{8 - 6}{9 - 6} = 0.67$$

c. Alternative 3 (A3)

$$A3_1 = \frac{9-6}{9-6} = 1.00$$

$$A3_5 = \frac{6-6}{8-6} = 0.00$$

$$A3_2 = \frac{8-5}{9-5} = 0.75$$

$$A3_6 = \frac{7-6}{8-6} = 0.50$$

$$A3_3 = \frac{6-6}{8-6} = 0.00$$

$$A3_7 = \frac{7-5}{9-5} = 0.50$$

$$A3_4 = \frac{7-5}{8-5} = 0.67$$

$$A3_8 = \frac{9-6}{9-6} = 1.00$$

d. Alternative 4 (A4)

$$A4_1 = \frac{6-6}{9-6} = 0.00$$

$$A4_5 = \frac{6-6}{8-6} = 0.00$$

$$A4_2 = \frac{6-5}{9-5} = 0.25$$

$$A4_6 = \frac{6-6}{8-6} = 0.00$$

$$A4_3 = \frac{8-6}{8-6} = 1.00$$

$$A4_7 = \frac{5-5}{9-5} = 0.00$$

$$A4_4 = \frac{7-5}{8-5} = 0.67$$

$$A4_8 = \frac{8-6}{9-6} = 0.67$$

e. Alternative 5 (A5)

$$A5_1 = \frac{6-6}{9-6} = 0.00$$

$$A5_5 = \frac{8-6}{8-6} = 1.00$$

$$A5_2 = \frac{6-5}{9-5} = 0.25$$

$$A5_6 = \frac{6-6}{8-6} = 0.00$$

$$A5_3 = \frac{8-6}{8-6} = 1.00$$

$$A5_7 = \frac{7-5}{9-5} = 0.50$$

$$A5_4 = \frac{6-5}{8-5} = 0.33$$

$$A5_8 = \frac{7-6}{9-6} = 0.33$$

f. Alternative 6 (A6)

$$A6_1 = \frac{7-6}{9-6} = 0.33$$

$$A6_5 = \frac{8-6}{8-6} = 1.00$$

$$A6_2 = \frac{7-5}{9-5} = 0.50$$

$$A6_6 = \frac{8-6}{8-6} = 1.00$$

$$A6_3 = \frac{8-6}{8-6} = 1.00$$

$$A6_7 = \frac{7-5}{9-5} = 0.50$$

$$A6_4 = \frac{6-5}{8-5} = 0.33$$

$$A6_8 = \frac{8-6}{9-6} = 0.67$$

g. Alternative 7 (A7)

$$A7_1 = \frac{8-6}{9-6} = 0.67$$

$$A7_5 = \frac{6-6}{8-6} = 0.00$$

$$A7_2 = \frac{7-5}{9-5} = 0.50$$

$$A7_6 = \frac{8-6}{8-6} = 1.00$$

$$A7_3 = \frac{7-6}{8-6} = 0.50$$

$$A7_7 = \frac{8-5}{9-5} = 0.75$$

$$A7_4 = \frac{7-5}{8-5} = 0.67$$

$$A7_8 = \frac{8-6}{9-6} = 0.67$$

h. Alternative 8 (A8)

$$A8_1 = \frac{7-6}{9-6} = 0.33$$

$$A8_5 = \frac{6-6}{8-6} = 0.00$$

$$A8_2 = \frac{9-5}{9-5} = 1.00$$

$$A8_6 = \frac{6-6}{8-6} = 0.00$$

$$A8_3 = \frac{7-6}{8-6} = 0.50$$

$$A8_7 = \frac{7-5}{9-5} = 0.50$$

$$A8_4 = \frac{8-5}{8-5} = 1.00$$

$$A8_8 = \frac{7-6}{9-6} = 0.33$$

i. Alternative 9 (A9)

$$A9_1 = \frac{7-6}{9-6} = 0.33$$

$$A9_5 = \frac{8-6}{8-6} = 1.00$$

$$A9_2 = \frac{5-5}{9-5} = 0.00$$

$$A9_6 = \frac{6-6}{8-6} = 0.00$$

$$A9_3 = \frac{8-6}{8-6} = 1.00$$

$$A9_7 = \frac{7-5}{9-5} = 0.50$$

$$A9_4 = \frac{7-5}{8-5} = 0.67$$

$$A9_8 = \frac{7-6}{9-6} = 0.33$$

j. Alternative 10 (A10)

$$A10_1 = \frac{8-6}{9-6} = 0.67$$

$$A10_5 = \frac{6-6}{8-6} = 0.00$$

$$A10_2 = \frac{7-5}{9-5} = 0.50$$

$$A10_6 = \frac{6-6}{8-6} = 0.00$$

$$A10_3 = \frac{7-6}{8-6} = 0.50$$

$$A10_7 = \frac{7-5}{9-5} = 0.50$$

$$A10_4 = \frac{8-5}{8-5} = 1.00$$

$$A10_8 = \frac{8-6}{9-6} = 0.67$$

Based on the normalization process above, it can be created in the form of Table 3 as follows :

Table 3. Normalization Results

No	Alternative	Criteria							
		C1	C2	C3	C4	C5	C6	C7	C8
1	A1	0.67	0.75	0.50	0.33	0.00	1.00	1.00	0.00
2	A2	0.33	0.75	0.50	0.00	1.00	0.00	0.25	0.67
3	A3	1.00	0.75	0.00	0.67	0.00	0.50	0.50	1.00
4	A4	0.00	0.25	1.00	0.67	0.00	0.00	0.00	0.67
5	A5	0.00	0.25	1.00	0.33	1.00	0.00	0.50	0.33
6	A6	0.33	0.50	1.00	0.33	1.00	1.00	0.50	0.67
7	A7	0.67	0.50	0.50	0.67	0.00	1.00	0.75	0.67
8	A8	0.33	1.00	0.50	1.00	0.00	0.00	0.50	0.33
9	A9	0.33	0.00	1.00	0.67	1.00	0.00	0.50	0.33
10	A10	0.67	0.50	0.50	1.00	0.00	0.00	0.50	0.67

4. Calculate preference values and make decision rankings

After obtaining the normalization results, the next stage is to carry out the calculation process for the total evaluation (preference value) of each alternative using the following equation (2) [19] :

$$V(x) = \sum_{i=1}^n w_i \cdot v_i(x) \quad (2)$$

Where:

$V(x)$ = Total evaluation of alternative x

w_i = Relative weight of criteria to -i

$v_i(x)$ = Results of evaluation criteria to -i of alternative x

i = Criterion index

The following is the calculation of the preference values of the alternatives using equation (2) :

$$\begin{aligned} A1 &= (0.05 \cdot 0.67) + (0.25 \cdot 0.75) + (0.05 \cdot 0.50) + (0.20 \cdot 0.33) \\ &\quad + (0.10 \cdot 0.00) + (0.20 \cdot 1.00) + (0.05 \cdot 1.00) \\ &\quad + (0.10 \cdot 0.00) = 0.56 \end{aligned}$$

$$\begin{aligned} A2 &= (0.05 \cdot 0.33) + (0.25 \cdot 0.75) + (0.05 \cdot 0.50) + (0.20 \cdot 0.00) \\ &\quad + (0.10 \cdot 1.00) + (0.20 \cdot 0.00) + (0.05 \cdot 0.25) \\ &\quad + (0.10 \cdot 0.67) = 0.41 \end{aligned}$$

$$\begin{aligned} A3 &= (0.05 \cdot 1.00) + (0.25 \cdot 0.75) + (0.05 \cdot 0.00) + (0.20 \cdot 0.67) \\ &\quad + (0.10 \cdot 0.00) + (0.20 \cdot 0.50) + (0.05 \cdot 0.50) \\ &\quad + (0.10 \cdot 1.00) = 0.60 \end{aligned}$$

$$\begin{aligned} A4 &= (0.05 \cdot 0.00) + (0.25 \cdot 0.25) + (0.05 \cdot 1.00) + (0.20 \cdot 0.67) \\ &\quad + (0.10 \cdot 0.00) + (0.20 \cdot 0.00) + (0.05 \cdot 0.00) \\ &\quad + (0.10 \cdot 0.67) = 0.31 \end{aligned}$$

$$\begin{aligned} A5 &= (0.05 \cdot 0.00) + (0.25 \cdot 0.25) + (0.05 \cdot 1.00) + (0.20 \cdot 0.33) \\ &\quad + (0.10 \cdot 1.00) + (0.20 \cdot 0.00) + (0.05 \cdot 0.50) \\ &\quad + (0.10 \cdot 0.33) = 0.34 \end{aligned}$$

$$\begin{aligned} A6 &= (0.05 * 0.33) + (0.25 * 0.50) + (0.05 * 1.00) + (0.20 * 0.33) \\ &+ (0.10 * 1.00) + (0.20 * 1.00) + (0.05 * 0.50) \\ &+ (0.10 * 0.67) = 0.65 \end{aligned}$$

$$\begin{aligned} A7 &= (0.05 * 0.67) + (0.25 * 0.50) + (0.05 * 0.50) + (0.20 * 0.67) \\ &+ (0.10 * 0.00) + (0.20 * 1.00) + (0.05 * 0.75) \\ &+ (0.10 * 0.67) = 0.62 \end{aligned}$$

$$\begin{aligned} A8 &= (0.05 * 0.33) + (0.25 * 1.00) + (0.05 * 0.50) + (0.20 * 1.00) \\ &+ (0.10 * 0.00) + (0.20 * 0.00) + (0.05 * 0.50) \\ &+ (0.10 * 0.33) = 0.55 \end{aligned}$$

$$\begin{aligned} A9 &= (0.05 * 0.33) + (0.25 * 0.00) + (0.05 * 1.00) + (0.20 * 0.67) \\ &+ (0.10 * 1.00) + (0.20 * 0.00) + (0.05 * 0.50) \\ &+ (0.10 * 0.33) = 0.36 \end{aligned}$$

$$\begin{aligned} A10 &= (0.05 * 0.67) + (0.25 * 0.50) + (0.05 * 0.50) + (0.20 * 1.00) \\ &+ (0.10 * 0.00) + (0.20 * 0.00) + (0.05 * 0.50) \\ &+ (0.10 * 0.67) = 0.48 \end{aligned}$$

Based on the calculation results of the preference values of each alternative above, it is known that alternative A1 has a value of 0.56, A2 has a value of 0.41, A3 has a value of 0.60, A4 has a value of 0.31, A5 has a value of 0.34, A6 has a value of 0.65, A7 has a value of 0.62, A8 has a value of 0.55, A9 has a value of 0.36, and A10 has a value of 0.48. The following are the results of the preferences and rankings which can also be seen in Table 4 below :

Table 4. Preference and Rating

Ranking	Alternative	Preference
1	A6	0.65
2	A7	0.62
3	A3	0.60
4	A1	0.56
5	A8	0.55
6	A10	0.48
7	A2	0.41
8	A9	0.36
9	A5	0.34
10	A4	0.31

4. CONCLUSION

The implementation of the MAUT method can be used as a consideration in decision-making [20]. This method of decision support helps in complex activities that require decision-making [21]. Based on the total evaluation results for each alternative, the total evaluation results for the 10 alternatives in this research were obtained. Each assessment criteria starts from the foreword component 5%, intrinsic elements 25%, extrinsic elements 5%, visual illustrations 20%, originality of work 10%, balance of idea proportions and writing techniques 20%, neatness and layout 5% and language style 10% will provide solutions in the assessment and decision-making process for all alternatives [3] [22]. With the MAUT method, you will also get results in the form of rankings [23]. There are three alternatives with the highest values, where A6 with a value of 0.65 is in the first rank, then A7 with a value of 0.62 is in the second rank and A3 with a value of 0.60 is in the third rank. The fourth rank is A1 with a value of 0.56, the fifth rank is A8 with a value of 0.55, the sixth rank is A10 with a value of 0.48, the seventh rank is A2 with a value of 0.41, the eighth rank is A9 with a value of 0.36, the ninth rank is A5 with

a value of 0.34, and the tenth rank is A4 with a value of 0.31. So that with the results of the total assessment calculation using the MAUT method, can provide the best decision results, especially for the three best rankings that provide recommendations for the results of the Yuwana Wikimedia project competition by the assessment institution and reduce the risk of errors in the assessment.

Based on the results obtained from the assessment of works from the Yuwana project competition, especially short story works which have eight criteria with each criterion having a different assessment weight. This will have a positive impact on the assessment board's recommendations regarding the decisions given. One of them is the increase in accuracy and quality of decisions due to a more in-depth analysis of alternatives.

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