APPLICATION OF THE SHANNON ENTROPY AND MULTI-OBJECTIVE OPTIMIZATION ON THE BASIS OF RATIO ANALYSIS PLUS FULL MULTIPLICATIVE FORM (MULTIMOORA) ON TAEKWONDO BELT INCREASE SELECTION

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Abstrack

This research uses the Shannon Entropy method for weighting and the MULTIMOORA method is used for the ranking process. In this study, the selection of belt increases will be carried out by considering several criteria, namely, KIbun Dongjak (Basic Movement), Poomsae, Poomsae Options, Chagi (Kicks), Kyorugi (Fighting), and Theory. Which aims to determine the level of accuracy generated by the two methods. The data used are the selection data for the increase in the taekwondo belt. The result of this study on the application of the Shannon Entropy method and the Multi-Objective Optimization Method On The Basis Of Ratio Analysis Plus Full Multiplicative Form (MULTIMOORA) for Geup 6 with 11 alternative data has an accuracy rate of 76%, for Geup 7 with 12 alternatives the data has an accuracy rate of 65%, for Geup 8 with an alternative number of 13 data has an accuracy rate of 77%, for Geup 9 with an alternative number of 14 data has an accuracy rate of 67%, while for Geup 10 with an alternative number of 6 data has an accuracy level of 86%.

Keywords*: Application Method, Belt Increase Selection, Taekwondo, Shannon Entropy, Multi-Objective Optimization On The Basis Of Ratio Analysis Plus Multiplicative Form, MULTIMOORA.*

1. INTRODUCTION

MTC stands for Murakata Taekwondo Club, which was founded by Gatot Permadi in the city of Barabai, Hulu Sungai Tengah regency in 1995. MTC Hulu Sungai Tengah has activities or routine activities that are on the agenda, including once in three months the belt promotion exam is centrally located at Dojang (college) designated as the exam site in the Barabai Hulu Sungai Tengah area.

Based on research by Aytekin & Karamasa (2017), there is a value or weight given using the Shannon Entropy method. This method aims to determine the weight of financial ratios with Fuzzy Shannon's Entropy which is obtained based on the set level α (α = 0.5) which states that the net profit margin is the most important

criterion. Then use Fuzzy TOPSIS as the final ranking. This method also relies on objective judgments which emphasize the importance of subjective judgments and the specification of criteria at the level of criteria weights that can be assigned together with the Entropy weights.

One of the ranking methods is found in the research of Ariam and Ashkan (2016) implementing the MULTIMOORA method into a case study of material selection. This case study aims to select materials used in various industries. Due to large quantities, different production techniques, and different properties of engineered materials, the material selection process can be considered a complicated undertaking for an engineer or designer. The MULTIMOORA method is a comprehensive form of the MOORA technique, because the final rank is generated by the integration of three subordinate ranks in the MULTIMOORA technique, the result can be stronger.

2. METHODOLOGY

This research method was carried out by stages in the Shannon Entropy and MULTIMOORA method. The following is the flow using the research method:

a. Problem identification, namely collecting various information related to research needs.
b. Collecting and analyzing criterion data, namely being a reference in determining which will be used for determining the passing selection. Each of the criteria used was based on interviews with the Upper Sungai Tengah Taekwondo College.
c. Obtaining the criterion weight value.
d. Determining the System Ratio for this method, the normalized index results are added for the attributes that are profitable (maximization) or subtracted for the attributes that are not profitable (minimization).
e. Determining the Reference Point determined for each criterion. When determining the highest reference point the value is selected for the maximization criterion, the minimum value is selected for the minimization criterion.
f. Determining the Full Multiplicative Form is similar to the system ratio, the optimal alternative can be distinguished by looking for the maximum among all the assessments.
g. Final Ranking is to perform alternative ranking to determine the highest to lowest value.
h. Perform prediction error calculations using MAPE calculations.

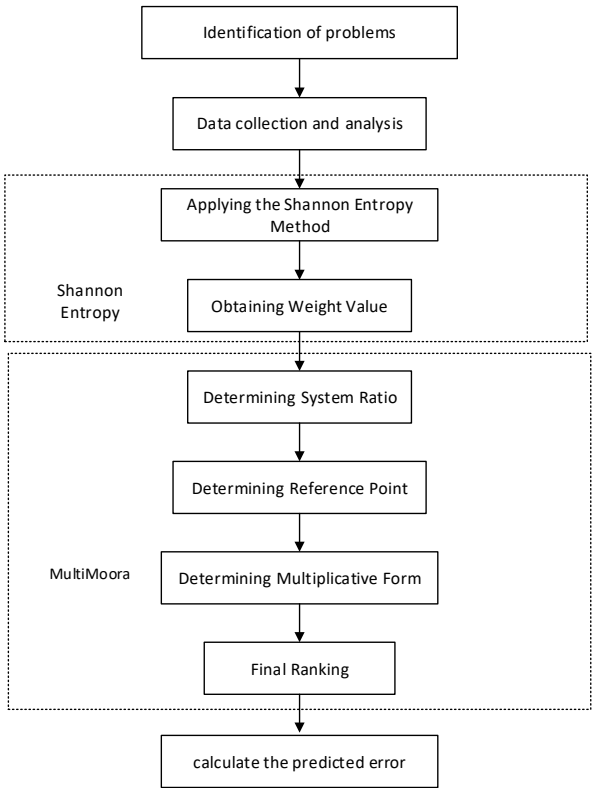

Figure 1. Flow of method

3. RESULTS AND DISCUSSION

The implementation of the case in this research is using Ms. Excel by using the data of participants in the selection for the increase in the taekwondo belt obtained from the MTC Hulu Sungai Tengah which consists of 11 data on the selection for the increase in the taekwondo belt and there are 6 criteria, namely kibun dongjak, poomsae, selected poomsae, chagi, kyorugi, and theory, which will be the reference for the selection assessment of the taewondo belt increase, namely:

1. Assessment Criteria

Table 1. Participant Assessment Criteria

Criteria	Sub Criteria
Kibun Dongjak	Accuracy, balance, strength, rhythm, expression.
Poomsae	Accuracy, balance, strength, expression.
Poomsae Pilihan	(the same as the poomsae assessment)
Chagi	(kicks)
Kyorugi	Point, offense, initiative, frequency, technical excellence
Teori	(based on a written exam)

2. Participant Data

The list of 56 data on participants who have participated in the selection for the taekwondo belt at MTC Hulu Sungai Tengah can be seen in table 2 below.

Table 2. Alternative data

No	Alternative	Geup
1	Muhammad Adie Gunawan	6
2	Radithya Bintang Afdhali	6
3	Ahmeed Zein Zeidan	6
4	Khawarizmi Anaqin Pasha	6
5	Noval Fadillah	6

6	Abrisam Al Hakim Gautama	6
7	Febriya Maulidah	6
8	Joan Adi Dearmando	6
9	Muhammad Amin Elmansyah	6
10	Sigit Prayata Yudha	6
11	Muhammad Nor Rasya	6

3.1 Calculations Using the Shannon Entropy Method

a. Determine the Decision Matrix

Decision matrix which includes alternative data and assessment criteria. Both of these consisted of 11 participants for the selection of a belt increase and 6 criteria and each sub-criteria, namely Kibun Dongjak, Pomsae, Pomsae Options, Chagi (Kicks), Kyorugi, Theory.

Table 3. Shannon Entropy Decision Matrix

Alternative	Kibun Dongjak	Poomsae	Poomsae Pilihan	Chagi	Kyorugi	Teori
Muhammad Adie Gunawan	61,6	63	60	65	61,4	68
Radithya Bintang Afdhali	72,4	64,25	65	65	69,2	72
Ahmeed Zein Zeidan	72	75,75	80	70	69,4	73
Khawarizmi Anaqin Pasha	70,2	64,25	65	65	69	76
Noval Fadillah	63,6	65,5	60	65	60	75
Abrisam Al Hakim Gautama	76,6	76,25	80	75	60,4	77
Febriya Maulidah	63	65,75	75	70	64,2	80
Joan Adi Dearmando	60	63	65	70	70,4	75
Muhammad Amin Elmansyah	63,4	64	60	65	62	67
Sigit Prayata Yudha	60,6	61,25	60	60	60	60
Muhammad Nor Rasya	68,4	71,75	70	75	62,4	75
TOTAL	**731,8**	**734,75**	**740**	**745**	**708,4**	**798**

b. Normalizing the Decision Matrix

Normalizing the decision matrix by dividing each element in the column by the number of each column in table 2 using equation 2 as follows:

$$p_{ij} = \frac{x_{ij}}{\sum_{j=1}^{m} x_{ij}} \; j = 1,2,\dots m \; ; i = 1,2,\dots n$$

Calculation description:

P1 = 61,6 / 731,8 = 0,0842
P2 = 63 / 734,75 = 0,0857
P3 = 60 / 740 = 0,0811
P4 = 65 / 745 = 0,0872
P5 = 61,4 / 708,4 = 0,0867
P6 = 68 / 798 = 0,0852

For the next step, the same process is carried out until the 6th row, then the results of the decision matrix normalization are obtained as follows.

Table 4. Normalizing the Shannon Entropy decision matrix

0,0842	0,0857	0,0811	0,0872	0,0867	0,0852
0,0989	0,0874	0,0878	0,0872	0,0977	0,0902

0,0984	0,1031	0,1081	0,0940	0,0980	0,0915
0,0959	0,0874	0,0878	0,0872	0,0974	0,0952
0,0869	0,0891	0,0811	0,0872	0,0847	0,0940
0,1047	0,1038	0,1081	0,1007	0,0853	0,0965
0,0861	0,0895	0,1014	0,0940	0,0906	0,1003
0,0820	0,0857	0,0878	0,0940	0,0994	0,0940
0,0866	0,0871	0,0811	0,0872	0,0875	0,0840
0,0828	0,0834	0,0811	0,0805	0,0847	0,0752
0,0935	0,0977	0,0946	0,1007	0,0881	0,0940

c. Calculating the Value of Entropy

Calculate the value of Entropy according to equation 3 as follows:

$$E_j = -k \sum_{j=1}^{m} p_{ij} . \ln p_{ij}$$

First the researcher calculates or determines the column normalization value x LN, the column normalization value first, as the calculation description below:

P1 = 0,0842 *x* LN 0,0842 = -0,2083
P2 = 0,0857 *x* LN 0,0857 = -0,2106
P3 = 0,0811 *x* LN 0,0811 = -0,2037
P4 = 0,0872 *x* LN 0,0872 = -0,2128
P5 = 0,0867 *x* LN 0,0867 = -0,2120
P6 = 0,0852 *x* LN 0,0852 = -0,2098

For the next step, the same process is carried out until the 6th row, in order to obtain the normalization value for column x LN, the normalization value for the column and the total value.

Table 5. Calculation of Column Normalization Value x LN Column Normalized Value

-0,2083	-0,2106	-0,2037	-0,2128	-0,2120	-0,2098
-0,2289	-0,2131	-0,2136	-0,2128	-0,2272	-0,2170
-0,2281	-0,2342	-0,2405	-0,2222	-0,2276	-0,2188
-0,2249	-0,2131	-0,2136	-0,2128	-0,2268	-0,2239
-0,2123	-0,2155	-0,2037	-0,2128	-0,2091	-0,2222
-0,2362	-0,2351	-0,2405	-0,2311	-0,2099	-0,2256
-0,2111	-0,2160	-0,2320	-0,2222	-0,2176	-0,2306
-0,2051	-0,2106	-0,2136	-0,2222	-0,2294	-0,2222
-0,2119	-0,2126	-0,2037	-0,2128	-0,2132	-0,2080
-0,2063	-0,2071	-0,2037	-0,2029	-0,2091	-0,1946
-0,2215	-0,2272	-0,2231	-0,2311	-0,2140	-0,2222
TOTAL	**-2,3947**	**-2,3951**	**-2,3918**	**-2,3957**	**-2,3959**	**-2,3951**

Then in the next step, calculate the entropy value as in the previous equation.

$$E_j = -(\ln m)^{-1} \sum_{i=1}^{m} p_{ij} \ln p_{ij}$$

Calculations:

E1 = - (1 / LN (11))* -2,3947 = 0,9987
E2 = - (1 / LN (11))* -2,3951 = 0,9988

E3 = - (1 / LN (11))* -2,3918 = 0,9975
E4 = - (1 / LN (11))* -2,3957 = 0,9991
E5 = - (1 / LN (11))* -2,3959 = 0,9992
E6 = - (1 / LN (11))* -2,3951 = 0,9988

Tabel 6. The value of *Entropy*

E	0,9987	0,9988	0,9975	0,9991	0,9992	0,9988

b. Determining the Weight of the Criteria
The final step in Shannon Entropy weighting is to assign weights to each criterion $w_j = (1 - E_j)/(n - \sum_{j=1}^{n} E_j)$
Information :
wj: Calculation Result Weight
E: the entropy value
n: Number of Criteria

Calculation :
W1 = (1 - 0,9987) / (6 - 5,9921) = 0,1695
W2 = (1 - 0,9988) / (6 - 5,9921) = 0,1458
W3 = (1 - 0,9975) / (6 - 5,9921) = 0,3210
W4 = (1 - 0,9991) / (6 - 5,9921) = 0,1137
W5 = (1 - 0,9992) / (6 - 5,9921) = 0,1027
W6 = (1 - 0,9988) / (6 - 5,9921) = 0,1474

Table 7. Results of weights on Shannon Entropy

W	Kibun Dongjak	Poomsae	Poomsae Pilihan	Chagi	Kyorugi	Teori
	0,1695	0,1458	0,3210	0,1137	0,1027	0,1474

3.2 The MULTIMOORA Method

a. The next step is to carry out weighted normalization.

Tabel 8. Results of weights on Shannon Entropy

W	0,1695	0,1458	0,3210	0,1137	0,1027	0,1474

Tabel 9. Normalization Matrix MULTIMOORA

Alternatif	Kibun Dongjak	Poomsae	Poomsae Pilihan	Chagi	Kyorugi	Teori
Muhammad Adie Gunawan	72	75,75	60	65	69,4	68
Radithya Bintang Afdhali	70,2	64,25	65	65	69	72
Ahmeed Zein Zeidan	63,6	65,5	80	70	60	73
Khawarizmi Anaqin Pasha	76,6	76,25	65	65	60,4	76
Noval Fadillah	63	65,75	60	65	64,2	75
Abrisam Al Hakim Gautama	60	63	80	75	70,4	77
Febriya Maulidah	63,4	64	75	70	62	80
Joan Adi Dearmando	60,6	61,25	65	70	60	75
Muhammad Amin Elmansyah	68,4	71,75	60	65	62,4	67

Sigit Prayata Yudha	60,4	62,5	60	60	68	60
Muhammad Nor Rasya	60	66,75	70	75	63	75
$\sqrt{\sum x^2 ij}$	217,2837	222,7553	224,4994	225,1111	214,0890	241,2592

After normalizing in Table 9, each of them will be divided by the normalized

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{n} x_{ij}^2}},$$

weight obtained in Shannon Entropy.
calculations :
r1 = 72 / 217,2837 = 0,3314
r2 = 75,75 / 222,7553 = 0,3401
r3 = 60 / 224,4994 = 0,2673
r4 = 65 / 225,1111 = 0,2887
r5 = 69,4 / 214,0890 = 0,3242
r6 = 68 / 241,2592 = 0,2819

the next step is to do the same calculation until the 11th alternative.

Tabel 10. Weighted normalization MULTIMOORA

Alternatif	Kibun Dongjak	Poomsae	Poomsae Pilihan	Chagi	Kyorugi	Teori
Muhammad Adie Gunawan	0,3314	0,3401	0,2673	0,2887	0,3242	0,2819
Radithya Bintang Afdhali	0,3231	0,2884	0,2895	0,2887	0,3223	0,2984
Ahmeed Zein Zeidan	0,2927	0,2940	0,3563	0,3110	0,2803	0,3026
Khawarizmi Anaqin Pasha	0,3525	0,3423	0,2895	0,2887	0,2821	0,3150
Noval Fadillah	0,2899	0,2952	0,2673	0,2887	0,2999	0,3109
Abrisam Al Hakim Gautama	0,2761	0,2828	0,3563	0,3332	0,3288	0,3192
Febriya Maulidah	0,2918	0,2873	0,3341	0,3110	0,2896	0,3316
Joan Adi Dearmando	0,2789	0,2750	0,2895	0,3110	0,2803	0,3109
Muhammad Amin Elmansyah	0,3148	0,3221	0,2673	0,2887	0,2915	0,2777
Sigit Prayata Yudha	0,2780	0,2806	0,2673	0,2665	0,3176	0,2487
Muhammad Nor Rasya	0,2761	0,2997	0,3118	0,3332	0,2943	0,3109

b. The Ratio System

The next step is the Ratio System approach, separating the benefit and cost criteria, adding all benefit values to the weighted normalization matrix.

$$y_i = \sum_{j \in \Omega_{\max}} w_j r_{ij} - \sum_{j \in \Omega_{\min}} w_j r_{ij},$$

calculations:
y1 = (0,1695 * 0,3314) + (0,1458 * 0,3401) + (0,3210 * 0,2673) + (0,1137 * 0,2887) + (0,1027 * 0,3242) + (0,1474 * 0,2819) = 0,2992
y2 = (0,1695 * 0,3231) + (0,1458 * 0,2884) + (0,3210 * 0,2895) + (0,1137 * 0,2887) + (0,1027 * 0,3223) + (0,1474 * 0,2984) = 0,2996
y3 = (0,1695 * 0,2927) + (0,1458 * 0,2940) + (0,3210 * 0,3563) + (0,1137 * 0,3110) + (0,1027 * 0,2803) + (0,1474 * 0,3026) = 0,3156

……..
y11 = (0,1695 * 0,2761) + (0,1458 * 0,2997) + (0,3210 * 0,3118) + (0,1137 * 0,3332) + (0,1027 * 0,2943) + (0,1474 * 0,3109) = 0,3045

Continue this step until alternative 11.

Table 11. The Ratio System

Alternative	Value
Muhammad Adie Gunawan	0,2992
Radithya Bintang Afdhali	0,2996
Ahmeed Zein Zeidan	0,3156
Khawarizmi Anaqin Pasha	0,3108
Noval Fadillah	0,2874
Abrisam Al Hakim Gautama	0,3211
Febriya Maulidah	0,3125
Joan Adi Dearmando	0,2902
Muhammad Amin Elmansyah	0,2898
Sigit Prayata Yudha	0,2734
Muhammad Nor Rasya	0,3045

c. The Reference Point Approach

In the Reference Point approach, because all the criteria in this study are benefits, the 6 values in the 6 criteria are compared then the max value is sought.

$$r^* = \{r_1^*, r_2^*, \ldots, r_n^*\} = \left\{\left(\max_i r_{ij} \middle| j \in \Omega_{\max}\right), \left(\min_i r_{ij} \middle| j \in \Omega_{\min}\right)\right\}.$$

Perhitungan :
r*1 = max (0 ; 0 ; 0,0286 ; 0 ; 0 ; 0) = 0
r*2 = max (0 ; 0 ; 0,0214 ; 0 ; 0 ; 0) = 0
r*3 = max (0,0101 ; 0 ; 0 ; 0 ; 0 ; 0) = 0
r*4 = max (0 ; 0 ; 0,0214 ; 0 ; 0 ; 0) = 0
……..
r*11 = max (0,0129 ; 0 ; 0,0143 ; 0 ; 0 ; 0) = 0

Table 12. The Reference Point approach

Kibun Dongjak	Poomsae	Poomsae Pilihan	Chagi	Kyorugi	Teori	max
0	0	0,0286	0	0	0	0
0	0	0,0214	0	0	0	0
0,0101	0	0	0	0	0	0
0	0	0,0214	0	0	0	0
0,0106	0	0,0286	0	0	0	0
0,0129	0	0	0	0	0	0
0,0103	0	0	0	0	0	0
0,0125	0,0098	0,0214	0	0	0	0

0	0	0,0286	0	0	0	0
0,0126	0	0,0286	0	0	0,0122	0
0,0129	0	0,0143	0	0	0	0

d. The Full Multiplicative Form

In the Full Multiplicative Form approach, because all the criteria in this study are benefits, from the 6 values in the 6 criteria all of them are multiplied, the results will be obtained.

$$y_i = \prod_{i=1}^{n} x_{ij}$$

Calculation the value of y1 :
y11 = 72 * 76 = 5454
y21 = 70 * 64 = 4510,35
y31 = 64 * 66 = 4165,8
y41 = 77 * 76 = 5840,75
……..
y141 = 60 * 67 = 4005
Calculation the value of y2 :
y12 = 5454 * 60 = 327240
y22 = 4510,35 * 65 = 293172,75
y32 = 4165,8 * 80 = 333264
y42 = 5840,75 * 65 = 379648,75
……
y142 = 4005 * 70 = 280350
Calculation the value of y3 :
y13 = 327240 * 65 = 21270600
y23 = 293172,75 * 65 = 19056228,8
y33 = 333264 * 70 = 23328480
y43 = 379648,75 * 65 = 24677168,8
……
y113 = 280350 * 75 = 21026250
Calculation the value of y4 :
y14 = 21270600 * 69 = 1476179640
y24 = 19056228,8 * 69 = 1314879784
y34 = 23328480 * 60 = 1399708800
y44 = 24677168,8 * 60 = 1490500993
……..
y114 = 21026250 * 63 = 1324653750
Calculation the value of y5 :
y14 = 1476179640 * 68 = 100380215520
y24 = 1314879784 * 72 = 94671344430
y34 = 1399708800 * 73 = 102178742400
y44 = 1490500993 * 76 = 113278075430
……..
y114 = 1324653750 * 75 = 99349031250

Repeat the calculation steps until row 11 of each criterion.

Table 13. The Full Multiplicative Form

x1	x2	x3	x4	x5
5454	327240	21270600	1476179640	100380215520
4510,35	293172,75	19056228,8	1314879784	94671344430
4165,8	333264	23328480	1399708800	102178742400
5840,75	379648,75	24677168,8	1490500993	113278075430
4142,25	248535	16154775	1037136555	77785241625
3780	302400	22680000	1596672000	122943744000
4057,6	304320	21302400	1320748800	105659904000
3711,75	241263,75	16888462,5	1013307750	75998081250
4907,7	294462	19140030	1194337872	80020637424
3775	226500	13590000	924120000	55447200000
4005	280350	21026250	1324653750	99349031250

e. Determine the last ranking order of the alternatives considered and choose the most appropriate. In this step, the alternatives considered are ranked according to:

- *Ratio System*
- *Reference Point,* and
- *Full Multiplicative Form*

Table 14. The results of the 3 approaches above

Alternative	RS	RP	FMF	Hasil
Muhammad Adie Gunawan	7	1	5	13
Radithya Bintang Afdhali	6	2	7	15
Ahmeed Zein Zeidan	2	3	4	9
Khawarizmi Anaqin Pasha	4	4	2	10
Noval Fadillah	10	5	9	24
Abrisam Al Hakim Gautama	1	6	1	8
Febriya Maulidah	3	7	3	13
Joan Adi Dearmando	8	8	10	26
Muhammad Amin Elmansyah	9	9	8	26
Sigit Prayata Yudha	11	10	11	32
Muhammad Nor Rasya	5	11	6	22

As a result of this ranking, three different rating lists were created, representing the rankings based on the RS approach, the RP approach and the FMF approach from the MULTIMOORA method. The final ranking of alternatives is based on dominance theory, that is, the alternative with the highest number of appearances in the first position on all ranking lists is the alternative with the best ranking.

Table 15. The ranking results use the MULTIMOORA method

Abrisam Al Hakim Gautama	8
Ahmeed Zein Zeidan	9

Khawarizmi Anaqin Pasha	10
Muhammad Adie Gunawan	13
Febriya Maulidah	13
Radithya Bintang Afdhali	15
Muhammad Nor Rasya	22
Noval Fadillah	24
Joan Adi Dearmando	26
Muhammad Amin Elmansyah	26
Sigit Prayata Yudha	32

3.3 Accuracy Testing

Data testing was carried out by calculating the level of accuracy of the ranking carried out with the taekwondo belt increase selection decision support system using the Shannon Entropy method and the Multi-Objective Optimization On The Basis Of Ratio Analysis Plus Full Multiplicative Form (MULTIMOORA). Mean Absolute Precentage Error (MAPE) is used to calculate the level of accuracy or for the error magnitude of the prediction from the system against the actual ranking that the user gives to an item. The calculation of the value of accuracy for the selection of taekwondo belt increases using the MAPE method can be seen in table 11 as follows.

Table 16. Accuracy Test Results

Alternatif	Rank		$\lvert A_i - F_i \rvert$	Real Rank
	Multimoora	MA		
Abrisam Al Hakim Gautama	1	1	0	0
Khawarizmi Anaqin Pasha	3	2	1	0,5
Febriya Maulidah	5	3	2	0,67
Ahmeed Zein Zeidan	2	4	2	0,5
Muhammad Adie Gunawan	4	5	1	0,2
Muhammad Nor Rasya	7	6	1	0,17
Radithya Bintang Afdhali	6	7	1	0,14
Muhammad Amin Elmansyah	10	8	2	0,25
Noval Fadillah	8	9	1	0,11
Joan Adi Dearmando	9	10	1	0,1
Sigit Prayata Yudha	11	11	0	0
Total				2,6373
MAPE				24%
Accuracy				76%

After getting the value of | A_i - F_i |, then divide by A_i. To get the error value, the total value of the real ranking is divided by the number of alternatives. The following is the calculation of accuracy:Perhitungan akurasi

$$MAPE = \left[\frac{\frac{\sum|A_i - F_i|}{A_i}}{n}\right] x\ 100\%$$

$$= \frac{2,6373}{11} X\ 100\%$$
$$= 24\%$$
$$\text{Accuracy} = 1 - \text{MAPE}$$
$$= 1 - 24\%$$
$$= 76\%$$

From the results of these tests it can be concluded that the application of the Shannon Entropy method and the Multi-Objective Optimization Method On The Basis Of Ratio Analysis Plus Full Multiplicative Form (MULTIIMOORA) for Geup 6 with 11 alternative data has an accuracy rate of 76%.

4. CONCLUSION

From the research that has been done, the following conclusions can be drawn:

a. The decision support system for taekwondo belt increase selection uses the Shannon Entropy method, namely determining pairwise comparisons, normalizing the values in each column, adding up the values in each column and determining the weight for each criterion. The weights obtained from Geup 6 are 0.1695, 0.1458, 0.3210, 0.1137, 0.1027, 0.1474, which will be followed by the Multi-Objective Optimization Method On The Basis Of Ratio Analysis Plus Full Multiplicative Form (MULTIMOORA) to determine ranking.
b. The results of the application of the Shannon Entropy method and the Multi-Objective Optimization On The Basis Of Ratio Analysis Plus Full Multiplicative Form (MULTIMOORA) in the selection of the taekwondo belt increase, there were 56 selection participants from 11 Geup 6 participants who had 76% accuracy results.

5. REFERENCES

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