SENSITIVITY TEST FUZZY TOPSIS AND FUZZY TOPSIS ROC METHODS FOR THE SELECTION OF THE SASIRANGAN BANJAR FABRIC MOTIFS

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Abstract

Decision making is one of problem that we often find in society, as well as choosing the fabric of the motif of Sasirangan Banjar that currently there are many kinds of it. So, to find out the ideal solution need the various of considerations that will make hesitation. And it will influence in time of accuracy of decision-making. Multi Atribut Decision Making (MADM) is a part of decision-making with various criteria that have a weight. The objective is to find out and ideal solution that can be optimal in implementation. The used Fuzzy TOPSIS and Fuzzy TOPSIS ROC methods an important to make an assesment with a simple system and calculation of priority weights to produces various motives. The result of two methods that have been test sensitivity are the best decision with the result 7,16% for weight Rank Order Centroid (ROC) and 0,6% for weight TOPSIS. So, Fuzzy TOPSIS ROC is better in values weight because it has a higher sensitivity than the Fuzzy TOPSIS.

Keywords: *Multi Attribute Decision Making, Fuzzy TOPSIS, Rank Order Centroid, Sensitivity, Sasirangan Banjar*

1. PRELIMINARY

Along with the development of technology, science has increasingly become more innovative and varied, especially in the field of Information Systems. The problem of decision making is one of the various problems that we often encounter in the community, such as in choosing the motif of the banjar sasirangan fabric which is currently increasingly diverse. So to find the ideal solution for a decision requires a variety of considerations that will bring doubts. Of course it will affect the timing and accuracy of decision making. Multi Attribute Decision Making is part of decision making with various criteria which have certain weights. The aim is to find an ideal and optimal solution in its application.

The TOPSIS method (Technique for Order Performance by Similiarity to Ideal Solution) is a decision making method introduced by [3] with the best alternative that has the closest distance to the positive ideal solution and the farthest distance with a negative ideal solution. A positive ideal solution can be interpreted as a total of all the best values achieved by the attribute. While the negative ideal solution is interpreted as the total of all the worst values achieved by the attribute. This method

is very commonly used in Decision Support Systems because of its easy and simple application.

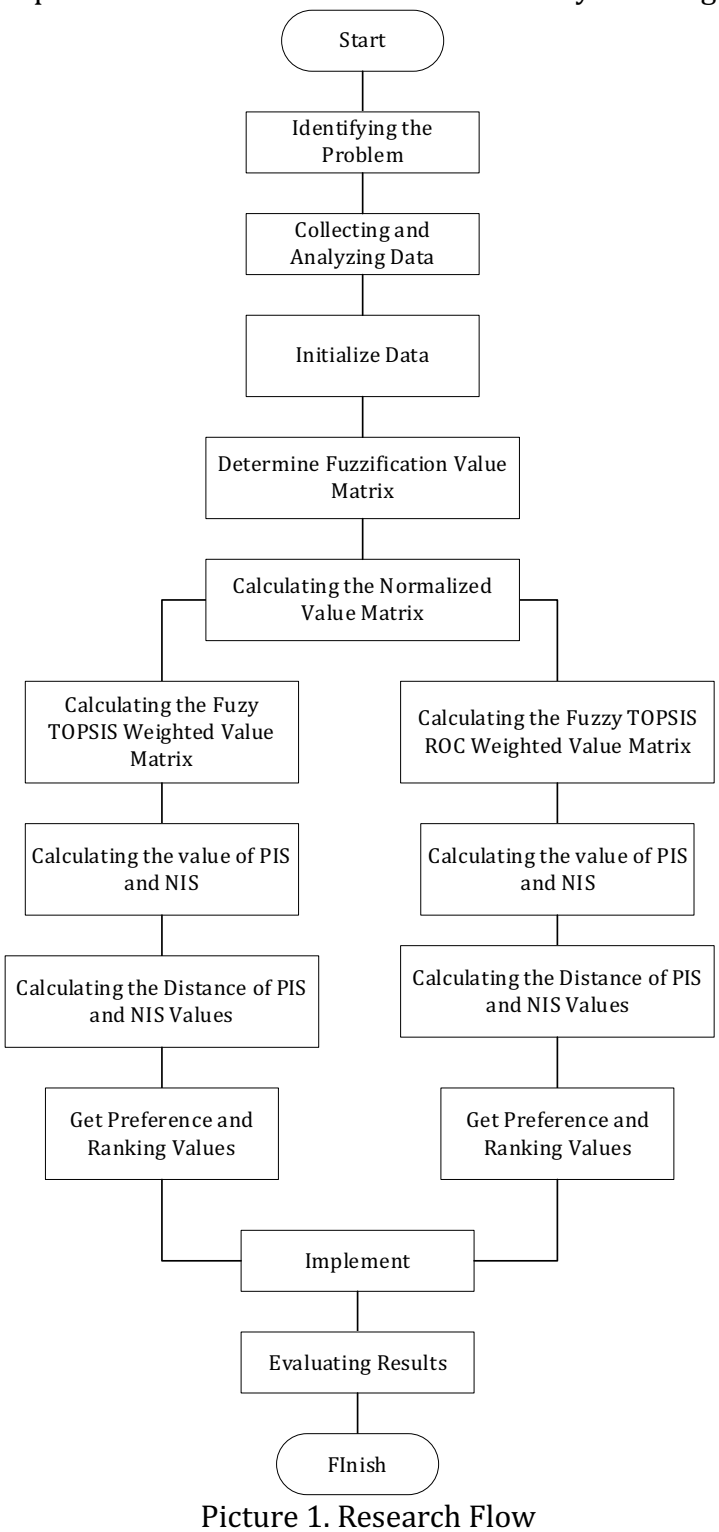
TOPSIS method has been widely applied as in journals [4] states that the TOPSIS method is a relevant method applied to his research with the highest sensitivity of 1,590%. In the implementation of this research needed a definite number that can measure the importance of criteria objectively. For this reason, because the data used is a mixture of strings and numbers, we need a method that can balance the input so that it can be measured. Fuzzy TOPSIS method can be applied in this case by identifying linguistic variables that are converted into Triangular Fuzzy Numbers in the form of numbers with 3 scales (lower, medium and upper).

In the selection step, weighting technique is needed that will affect the final ranking results to achieve optimal value. Weighting in the TOPSIS method uses a range of weights according to the initialization of the importance value of the decision maker. Whereas the Rank Order Centroid (ROC) weighting technique uses an equation based on the priority level of criteria and the number of criteria with a total value of criteria equal to one so that the final result becomes more optimal. As in the study [1] which concluded that weighting with ROC technique is better than AHP weighting with the smallest sensitivity value, which is 0,0011.

The purpose of this study was to examine the superiority of the TOPSIS weighting technique with Fuzzy TOPSIS ROC in providing recommendations for resolving the Sasirangan Banjar fabric motif selection. The testing process for these two methods is carried out with a sensitivity test which adds a weight of 0,5 and 1 to each criterion.

2. RESEARCH METHODS

The work procedures that will be used in this study are in figure 1 as follows.



Picture 1. Research Flow

a. Identifying the Problem

Identifying problems by looking for problems that can be given a solution by gathering various information by studying on lecture materials, books, scientific journals and various internet sources in the form of deepening

Decision Support Systems (SPK), conceptual methods on implementing SPK, data processing and systems on applications web-based and direct comparative studies to Sasirangan craftsmen.

b. Collecting and Analyzing Data
In this study three data collection methods were used namely observation, Literature Study Method, and Interview Interviewees. Observations were made by visiting the research location directly to see first hand the sasirangan products. Literature study is done by finding material to complement the supporting theories of literature used. While the interview was conducted with Sasirangan to explore information related to product sales and research data requirements. The data that has been obtained is then analyzed by identifying criteria that can be used as variables, processing data and determining the priority level of criteria.

c. Initialize Data
At this stage, it is a process of initializing data by changing the input string and nominal into integers, making it easier to calculate the next process.

d. Determine Fuzzification Value Matrix
Fuzzification value at this stage is taken from the data initialization which is then converted into a Triangular Fuzzy Number based on the analyzed preference value.

e. Calculating the Normalized Value Matrix
The determined fuzzification value is changed to normal value in the normalized value matrix table so that the next process can be done.

f. Calculating the Weighted Value Matrix
Normalized value data will be calculated using the Fuzzy TOPSIS and ROC methods to produce a weighted value matrix table according to their respective weights.

g. Calculating the value of PIS and NIS
Calculating the value of Positive Ideal Solution (PIS) and Negative Ideal Solution (NIS) is done by finding the minimum and maximum values for each criterion with the different provisions in the benefit and cost criteria.

h. Calculating the Distance of PIS and NIS Values
Calculating the Distance between the value of PIS and NIS is obtained from the calculation of the value of PIS and NIS which are operated with a weighted value matrix so that the closest and the farthest distance from the positive ideal solution and the negative ideal solution are obtained.

i. Get Preference and Ranking Values
Get the preference value from the calculation of the distance of positive values and the distance of negative values to get the order of the results from the largest to the smallest of each method. Fabric motifs will be selected based on the best ranking order.

j. Implement
The stage for applying the methods in the system that will be used in the process of determining the best choice with a Decision Support System is to use the Fuzzy TOPSIS method compared to the Fuzzy TOPSIS method with Fuzzy TOPSIS ROC. So that it will produce a decision support that displays recommendations Sasirangan fabric motifs in accordance with the best results.

k. Evaluating Results

At this stage, the evaluation of results is carried out by conducting a Sensitivity Test on the results of the data to see how sensitive this research method is after adding the Fuzzy TOPSIS ROC method. From the results of the level of sensitivity can be seen how the quality of the method in solving problems related to the sale of Sasirangan products so that it can help in the decision making process for customers.

3. RESULTS AND DISCUSSION

3.1 Results

3.1.1 Data collection

The data used in this study were obtained from Sasirangan craftsmen located in Sungai Tiung Village, Cempaka District, Banjarbaru City with selected data so that they can be used as input. In these data identification is carried out to obtain criteria, namely fabric type, price, category of motifs, number of colors and size of fabric.

3.1.2 Calculation of Fuzzy TOPSIS and Fuzzy TOPSIS ROC methods

The following results of the analysis of the criteria to produce the following categories and weights.

Table 1. Criteria Categories and Weighting Methods

No	Criteria	Category	Fuzzy TOPSIS Method	Fuzzy TOPSIS ROC method
1	Fabric Type	Benefit	5	0,46
2	Price	Cost	4	0,26
3	Motif Category	Benefit	3	0,16
4	Number of Colors	Benefit	3	0,09
5	Fabric Size	Benefit	2	0,04

The results of alternative calculations on the two methods can be seen in the following table.

Table 2. Calculation Result of Fuzzy Topsis Method and Fuzzy TOPSIS ROC

A	Alternative	Fuzzy TOPSIS	Fuzzy TOPSIS ROC
A1	Sari Gading	0,6569	0,7074
A2	Bangkal Flower	0,6901	0,7574
A3	Kelakai	0,7006	0,7433
A4	Halilipan	0,6020	0,6245
A5	Leaf	0,6666	0,7743
A6	Diamond	0,6705	0,7398
A7	Banjar House	0,4216	0,5014

From the calculation data above, it can be seen that there are differences in the ranking results of each method of Fuzzy TOPSIS and Fuzzy TOPSIS ROC. Where the Fuzzy TOPSIS method chosen as the best alternative is A3, which is the motif of wear. Whereas the Fuzzy TOPSIS ROC method chosen as the best alternative is A5, the leaf motif. For this reason, a sensitivity method is needed to find out the relevant method applied in this case study.

3.1.3 Sensitivity Test

Sensitivity tests were performed for testing the superiority of the weighting

technique TOPSIS with Fuzzy TOPSIS ROC in providing recommendations for choosing the Sasirangan Banjar fabric motif based on the ranking changes for each test [2].

Table 3. Preferred value Weight Criteria 1 + (0,5)

A	Fuzzy TOPSIS	Fuzzy TOPSIS ROC
A1	0,6539	0,6350
A2	0,6943	0,7810
A3	0,7044	0,7744
A4	0,6100	0,7202
A5	0,6712	0,7884
A6	0,6753	0,7727
A7	0,5851	0,6789
Max	**0,7044**	**0,7884**
Change	**-0,3787%**	**-1,4014%**

Table 4. Preferred value Weight Criteria 1 + (1)

A	Fuzzy TOPSIS	Fuzzy TOPSIS ROC
A1	0,6510	0,6115
A2	0,6985	0,7903
A3	0,7083	0,7867
A4	0,6180	0,7576
A5	0,6760	0,7940
A6	0,6801	0,7859
A7	0,4611	0,7636
Max	**0,7083**	**0,7940**
Change	**-0,3835%**	**-0,5629%**

Table 5. Preferred value Weight Criteria 2 + (0,5)

A	Fuzzy TOPSIS	Fuzzy TOPSIS ROC
A1	0,6773	0,8579
A2	0,7025	0,8044
A3	0,7120	0,8001
A4	0,5858	0,4894
A5	0,6800	0,8089
A6	0,6842	0,7990
A7	0,3972	0,2617
Max	**0,7120**	**0,8579**
Change	**-0,3772%**	**-6,3926%**

Table 6. Preference Value Weight Weighting Criteria 2 + (1)

A	Fuzzy TOPSIS	Fuzzy TOPSIS ROC
A1	0,6959	0,9079
A2	0,7136	0,8136
A3	0,7223	0,8118
A4	0,5715	0,4622
A5	0,6923	0,8155
A6	0,6966	0,8114
A7	0,3752	0,1765
Max	**0,7223**	**0,9079**
Change	**-1,0261%**	**-4,9948%**

Table 7. Preference Value Weight Weighting Criteria 3 + (0,5)

A	Fuzzy TOPSIS	Fuzzy TOPSIS ROC
A1	0,6995	0,9122
A2	0,7154	0,8308
A3	0,7172	0,7991

A4	0,6389	0,8844
A5	0,7057	0,9327
A6	0,6931	0,7988
A7	0,4326	0,7489
Max	**0,7172**	**0,9327**
Change	**0,5075%**	**-2,4835%**

Table 8. Value preference Weight Weighting Criteria 3 + (1)

A	Fuzzy TOPSIS	Fuzzy TOPSIS ROC
A1	0,6654	0,8356
A2	0,6680	0,4933
A3	0,6634	0,3793
A4	0,6147	0,8002
A5	0,6752	0,8744
A6	0,6387	0,3787
A7	0,4195	0,4381
Max	**0,6752**	**0.8744**
Change	**4,2061%**	**5,8260%**

Table 9. Preference Value Weight Weighting Criteria 4 + (0,5)

A	Fuzzy TOPSIS	Fuzzy TOPSIS ROC
A1	0,6367	0,4737
A2	0,6857	0,6694
A3	0,6958	0,6646
A4	0,6136	0,7523
A5	0,6445	0,4911
A6	0,6672	0,6633
A7	0,4263	0,4263
Max	**0,6958**	**0,7523**
Change	**-2,03636%**	**12,2138%**

Table 10. Preference Weight Weight Criteria 4 + (1)

A	Fuzzy TOPSIS	Fuzzy TOPSIS ROC
A1	0,6168	0,3662
A2	0,6812	0,6273
A3	0,6907	0,6254
A4	0,6256	0,8341
A5	0,6231	0,3756
A6	0,6637	0,6249
A7	0,4315	0,5637
Max	**0,6907**	**0,8341**
Change	**0,5046%**	**-8,1812%**

Table 11. Preferred value Weight Criteria 5 + (0,5)

A	Fuzzy TOPSIS	Fuzzy TOPSIS ROC
A1	0,6464	0,5123
A2	0,6762	0,5284
A3	0,7034	0,7904
A4	0,5920	0,4587
A5	0,6551	0,5351
A6	0,6583	0,5242
A7	0,4181	0,4162
Max	**0,7034**	**0,7904**
Change	**-1,2647%**	**4,3667%**

Table 12. Value preference Weight Weighting Criteria 5 + (1)

A	Fuzzy TOPSIS	Fuzzy TOPSIS ROC
A1	0,6346	0,3696
A2	0,6610	0,3789
A3	0,7066	0,8459
A4	0,5808	0,3279
A5	0,6423	0,3837
A6	0,6447	0,3770
A7	0,4139	0,3172
Max	**0,7066**	**0,8459**
Change	**-0,3254%**	**-5,5506%**

Table 13. Percentage Change in Sensitivity Test

Criteria	Fuzzy TOPSIS	Fuzzy TOPSIS ROC
K1 + (0,5)	-0,3787%	-1,4014%
K1 + (1)	-0,3835%	-0,5629%
K2 + (0,5)	-0,3772%	-6,3926%
K2 + (1)	-1,0261%	-4,9948%
K3 + (0,5)	0,5075%	-2,4835%
K3 + (1)	4,2061%	5,8260%
K4 + (0,5)	-2,0636%	12,2138%
K4 + (1)	0,5046%	-8,, 812%
K5 + (0,5)	-1,2647%	4,3667%
K5 + (1)	-0,3254%	-5,5506%
amount	**0,6011%**	**7,1603%**

3.2 Discussion

For the sensitivity test results of fabric type criteria (K1) there are similarities in ranking results on the results of the Fuzzy TOPSIS method with different values. So get a percentage change of -0,3787% and -0,3835%. Whereas the Fuzzy TOPSIS ROC method also experienced similar ranking results with a percentage change of -1,4014% and -0,5629%.

For the price criterion sensitivity test results (K2) there are similarities in ranking results on the results of the Fuzzy TOPSIS method with different values. So get a percentage change of -0,3772% and -1,0226%. As for the Fuzzy TOPSIS ROC method, the ranking changes with the best alternative, namely the betel leaf motif A1 code with a percentage change of -6,3926% and -4,9948%.

For the sensitivity test results of the motive category criteria (K3) there is a difference in the ranking results of the TOPSIS Fuzzy method in the K3 + calculation (1) with the best ranking, namely the A4 leaf code motif, but in the K3 + calculation (0,5) there is no ranking change. Percentage of changes produced are0,5075% and 4,2061%. As for the Fuzzy TOPSIS ROC method, there was no change in ranking with a percentage change of -2,4835% and 5,8260%.

For the sensitivity test results of the number of color criteria (K4) there are similarities in ranking results on the results of the Fuzzy TOPSIS method with different values. So getting a percentage change of -2,0636% and 0,5046%. As for the Fuzzy TOPSIS ROC method, the ranking changes with the best alternative, the A4 code leaf motif with a percentage change 12,2138% and -8,1812%.

For the sensitivity test results of fabric size criteria (K5) there are similarities in ranking results on the results of the Fuzzy TOPSIS method with different values. So get a percentage change of -1,2647% and -0,3254%. As for the Fuzzy TOPSIS ROC method, the ranking changes with the best alternative, namely the use of the A3 code with a percentage change 4,3667% and -5,5506%.

While the sensitivity test produces values with different percentage changes for each criterion where the Fuzzy TOPSIS ROC method produces the largest percentage changes in each criterion with the following description.

a. The sensitivity test results by adding 0,5 weights to the fabric type criteria (K1) experienced a percentage change of -0,3787% in the Fuzzy TOPSIS method and -1,4014% in the Fuzzy TOPSIS ROC method. Whereas the addition of weight 1 experienced a percentage change of -0,3835% in the Fuzzy TOPSIS method and -0,5629% in the Fuzzy TOPSIS ROC method.
b. The sensitivity test results by adding 0,5 weights to the price criteria (K2) experienced a percentage change of -0,3772% in the Fuzzy TOPSIS method and -6,33926% in the Fuzzy TOPSIS ROC method. Whereas with the addition of weight 1 experienced a percentage change of-1,0261% in the Fuzzy TOPSIS method and -4,9948% in the Fuzzy TOPSIS ROC method.
c. The sensitivity test results by adding 0,5 weights in the criteria category of motives (K3) experienced a percentage change of 0,5075% in the Fuzzy TOPSIS method and -2,4835% in the Fuzzy TOPSIS ROC method. Whereas with the addition of weight 1 experienced a percentage change of4,2061%in the Fuzzy TOPSIS method and 5,8260% in the Fuzzy TOPSIS ROC method.
d. The sensitivity test results by adding 0,5 weights on the number of color criteria (K4) experienced a percentage change of -2,0636% in the Fuzzy TOPSIS method and 12,2138% in the Fuzzy TOPSIS ROC method. Whereas with the addition of weight 1 experienced a percentage change of 0,5046%in the Fuzzy TOPSIS method and -8,1812% in the Fuzzy TOPSIS ROC method.
e. While the sensitivity test results by adding 0,5 weights to the fabric size criteria (K5) experienced a percentage change of -1,2647% in the Fuzzy TOPSIS method and 4,3667% in the Fuzzy TOPSIS ROC method. Whereas with

the addition of weight 1 experienced a percentage change of-0,3254% in the Fuzzy TOPSIS method and -5,5506% in the Fuzzy TOPSIS ROC method.

3 CONCLUSION

From the results of the research that has been carried out it can be concluded that the sensitivity test results of each method is equal to 0,6% for Fuzzy TOPSIS with an alternative data that changes when tested. While the test results of the Fuzzy TOPSIS ROC method produced a percentage change of 7,16% with four alternative data that experienced changes when tested. This proves that the Fuzzy TOPSIS method with the Fuzzy TOPSIS ROC is more sensitive than the Fuzzy TOPSIS method which results in a percentage change of 7,16%.

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