Implementation of Tahani

by Edy Win

Submission date: 12-Mar-2019 10:13AM (UTC+0700)
Submission ID: 1091812315
File name: Implementation_of_Tahani.pdf (1.07M)
Word count: 3362
Character count: 16736

Implementation of Tahani Fuzzy Logic Method for Selection of Optimal Tourism Site

Wiwien Hadikurniawati[1], Edy Winarno[2], Arif Budi Prabowo[3], Dahlan Abdullah[4]

[1,2,3]Faculty of Information Technology, Universitas Stikubank, Semarang, Indonesia
[4]Department of Informatics,Universitas Malikussaleh, Aceh Utara, Indonesia

*wiwien@edu.unisbank.ac.id

Abstract. Indonesia has a variety of tourism industries. Travel makes people's interest increase in visiting tourist sites. A recommendation application in the field of tourism is needed for the selection of the right tourism object was to be implemented in Central Java. This application is expected to provide information on prospective tourists in choosing tourist attractions effectively. This application can facilitate prospective tourists to choose tourist objects that match the criteria by applying the fuzzy tahani method. Fuzzy Tahani describe a fuzzy query processing method, based on language manipulation known as SQL (Structured Query Language). The Fuzzy Tahani model is very appropriate to be used in the process of finding the right and accurate data. Variables used in this application are variable ticket prices, number of facilities, number of visitors, distance traveled and types of tourist attractions.
Keyword: Fuzzy Tahani, Fuzzy Query, Tourist Site, Decision Making

1. Introduction

The tourism industry is a collection of interrelated tourism businesses aimed at producing goods and services for meeting the needs of tourists. Tourism is a leading sector that is expected to be able to drive the Indonesian economy. Existing data on tourism is not enough to help tourists determine the choice of tourist sites [1][2]. The number of tourist attractions with several choices of facilities, ticket prices and distance to the location confuses tourists who will visit the tourist attractions. To make it easier for tourists to choose tourist objects, decision making is needed to solve the problem [3].

Multi attribute decision making is a field of research that is still widely studied by researchers. The Multi-Atributte Decision Making (MADM) is the study of decision-making methods an d procedures in which there are concerns about conflicting criteria in an unstructured [4]. With a series of limited multi-criteria and alternatives, the problem of decision making consists of ranking each alternative from the best to the worst. In the case of MADM, decision-making preferences information is often used to determine alternative ratings[5].

The approaches to solving MADM problem can be classified into three categories according to different preference information given by the decision makers [6]: (1) without preference information [7], (2) with preference information on attributes [8][9], and (3) with preference information on alternatives. Research on multi-attribute decision making has been carried out by researchers. The research on MADM electrician [8][9][10], supplier selection [11], contractor selection [12][13]. Problem of contractor

selection is an MADM problem because it involve subjective judgments, multiple decision makers and multiple criteria.

The fuzzy concept is applied to measure alternative ranks and rank criteria in the proposed MADM assessment model. Fuzzy theory allows handling uncertainty in information by allowing obscurity in the spesification of the information. Priority ratings for each criteria are given a membership value for fuzzy subsets that are determined by the membership value.

Fuzzy logic studies on decision making have been developed by researchers. Research has been developed by [14] using the Tahani Fuzzy model for several criteria such as price, size, memory capacity, RAM in determining the selection of a computer. [15] in their research has developed a fuzzy tahani model to provide recommendations in determining the right employee for the promotion of positions in a company.

In the process of finding the optimum location that meet desired conditions the analyst is challenged by management of multi-attribute decision making. The management that can be formed to attract tourists is to build a system that is able to provide information quickly and precisely on tourist objects. The system is expected to help tourists in making decisions about the selection of attractions effectively. This study will discuss the decision support system for choosing tourist attractions, especially in Central Java using the fuzzy tahani model.

This paper is organized as follows: In Section 2, we give the basic theory of our model. In Section 3, we present our algorithm and proposed model used to find the best alternative. In Section 4, we discuss the testing and evaluation results. Some conclusions are parts of Section 5.

2. Fuzzy Model

The classic database only handles crisp data. Whereas in reality humans often communicate in languages that contain uncertain data. To solve this problem a database with a fuzzy logic approach was built. A database that uses a fuzzy approach not only stores and manipulates crisp data but also subjective opinions, decisions and values that can be explained in linguistic terms. In general, there are two ways to put in elements of fuzziness into a database, namely:

2.1. *Fuzzy Database*

Fuzzy database is a database that has the ability to store and manipulate data directly. This database contains uncertainty. Users provide information that contains elements of obscurity into the database. This type of database is also supported by fuzzy queries to obtain information.

2.2. Fuzzy Query Database

Fuzzy database query is to create a fuzzy query in a classic database. The query has linguistic variables. While the data in the database that will be accessed is certain data. The database proposed by Tahani is a form of Fuzzy Query Database. The Tahani database still uses standard relations and this model uses fuzzy set theory to obtain information in its query.

3. Methodology

The database of the fuzzy Tahani model uses a standard relation but this model uses fuzzy set theory to get the query information. The preliminaryl data is data that has a crisp value. The next step is the fuzzy data search process called fuzzy query process through fuzzy database model Tahani. The idea of a fuzzy database model of the Tahani system is to define the concept of a fuzzy database in a system database using membership

degrees.The stages of the research are carried out based on the block diagram in the figure 1.

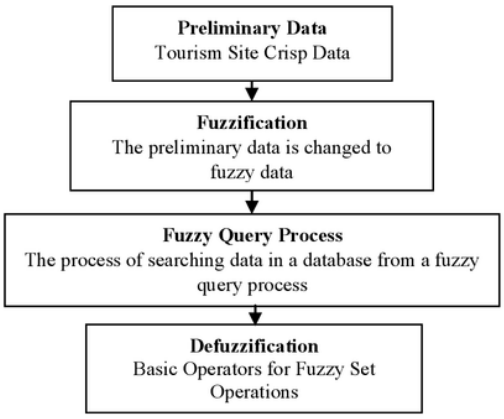

Figure 1. Research Process

Based on the stages of the research process in figure 1 can be explained as follows : in preliminary data, all data relating to parameters and alternatives from tourist attractions are prepared. The data is crisp data. Membership function is a curve that shows the use of data input into its membership value. Membership function have intervals between 0 and 1. A way that can be used to get membership values through a function approach.

The membership function in a fuzzy system is a combination membership degree between the left shoulder curve function, the triangle curve, and the right shoulder curve. The domain of each function starts from 0 to ∞ (infinite), so that the domain of the function is more flexible.

Fuzzification is the conversion of crisp values to fuzzy values. Fuzzy Inference System (FIS) is a system for making conclusions from a set of fuzzy rules. In this study the results of the FIS will determine the value of recommendations from tourist attractions. Query fuzzification is assumed to be a conventional query database management system creates and implements a basic system of fuzzy query logic.

The membership value of 2 fuzzy sets is called Fire Strength or α-predicate. Basic operators are used in the query process, namely AND and OR operators. α-predicate as a result of AND operator operation is obtained by selecting the smallest membership value in the respective sets. It can seen in Equation 1.

$$\mu A \cap B = \min(\mu A[x], \mu B[y]) \quad (1)$$

The results of calculations with OR operators are obtained by selecting the largest membership value in the sets, can be seen in equation 2:

$$\mu A \cup B = \max(\mu A[x], \mu B[y]) \quad (2)$$

Alternative recommendations are chosen from alternatives that have 'fire strength' values between 0 and 1.

4. Result and Analysis

In Tahani fuzzy database, initially a fuzzy set is formed with its membership function. To assess the desired tourist attractions, several categories are formed which need to be considered with the set of each parameter. These parameters are price, facility, number of visitors, distance.

The database used in this study is the Tahani database and the database structure used is a relational database structure. Tourist attractions data used in the selection can be seen in table 1. The selected data will be processed using fuzzy tahani method with the parameters desired by tourists. This process is expected to produce appropriate tourist recommendations.

Table 1. Tourist Attraction Data

No	Place Name	Ticket Price	Number of Facilities	Number of Visitors per month	Distance from The Capital of Central Java (km)
1	Borobudur Temple	IDR 50000	2	3200	150
2	Bandengan Beach	IDR 5000	18	4500	101
3	Kartini Beach	IDR 5000	12	3450	102
4	Mpu Rancak Beach	IDR 3000	11	1403	105
5	Menganti Beach	IDR 10000	9	1540	185
6	Kartini Museum	IDR 7500	6	1670	110
7	Mantingan Mosque	free	1	7600	112
8	Hian Thian Siang Tee Pagoda	IDR 3000	1	8600	105
9	Cinta Hill	IDR 6500	2	1260	15
10	Ranjeng Lake	IDR 6000	1	9540	210

Membership function of each variable fuzzy uses a combination of a left shoulder curve, triangle curves and right shoulder curve for set which has 3 fuzzy sets.
For membership function that have 2 fuzzy sets using a combination of left shoulder and right shoulder curve.

4.1.Ticket Price

Domain of functions membership of parameter 1 (ticket price) is presented at Figure 2. Ticket price parameter are divided into 3 interval fuzzy : Cheap, Normal, Expensive

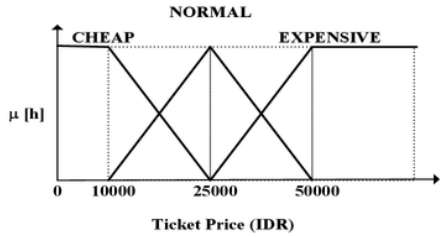

Figure 2. Membership Function Curve of Ticket Price Parameter

Membership function of ticket price :

$$\mu CheapPrice[h] = \begin{cases} 1 & \rightarrow \quad h < 10.000 \\ \frac{25.000 - h}{15.000} & \rightarrow \quad 10.000 \leq h \leq 25.000 \\ 0 & \rightarrow \quad h > 25.000 \end{cases}$$

$$\mu NormalPrice[h] = \begin{cases} 0 & \rightarrow \quad h \geq 50.000 \text{ or } h < 10.000 \\ \frac{h - 10.000}{15.000} & \rightarrow \quad 10.000 \leq h \leq 25.000 \\ \frac{50.000 - h}{25.000} & \rightarrow \quad 25.000 \leq h < 50.000 \end{cases}$$

$$\mu ExpensivePrice[h] = \begin{cases} 0 & \rightarrow \quad h < 25.000 \\ \frac{h - 25.0(}{25.000} & \rightarrow \quad 25.000 \leq h < 50.000 \\ 1 & \rightarrow \quad h \geq 50.000 \end{cases}$$

Degree of membership at ticket price parameter can be seen in table 2.

Tabel 2. Degree of Membership at Ticket Price Parameter

No	Tourism Site Name	Ticket Price	Membership Degree (h)		
			Cheap	Normal	Expensive
1	Borobudur Temple	IDR 50000	0	0	1
2	Bandengan Beach	IDR 5000	1	0	0
3	Kartini Beach	IDR 5000	1	0	0
4	Empu Rancak Beach	IDR 3000	1	0	0
5	Menganti Beach	IDR 10000	1	0	0
6	Kartini Museum	IDR 7500	1	0	0
7	Mantingan Mosque	IDR 0	1	0	0
8	Hian Thian Siang Tee Pagoda	IDR 3000	1	0	0
9	Cinta Hill	IDR 6500	1	0	0
10	Ranjeng Lake	IDR 6000	1	0	0

4.2. Facilities of Tourist Attraction

From table 1 above, fuzzification is performed using the facility parameter membership function which divides it into 3 criteria, namely Less, Enough, and Good.

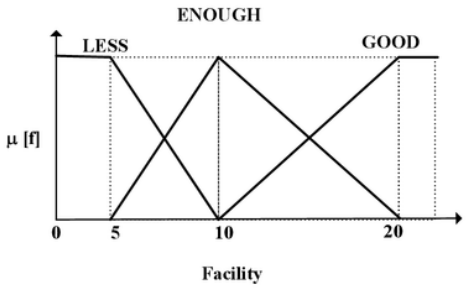

Figure 3. Membership Function Curve of Facility Parameter

Membership function at facility parameter :

$$\mu LessFacility[f] = \begin{cases} 1 & \rightarrow \quad f < 5 \\ \frac{10-f}{5} & \rightarrow \quad 5 \leq f < 10 \\ 0 & \rightarrow \quad f \geq 10 \end{cases}$$

$$\mu EnoughFacility[f] = \begin{cases} 0 & \rightarrow \quad f < 5 \\ \frac{f-5}{5} & \rightarrow \quad 5 \leq f < 10 \\ \frac{20-f}{10} & \rightarrow \quad 10 \leq f \leq 20 \end{cases}$$

$$\mu GoodFacility[f] = \begin{cases} 0 & \rightarrow \quad f < 10 \\ \frac{f-10}{10} & \rightarrow \quad 10 \leq f < 20 \\ 1 & \rightarrow \quad f \geq 20 \end{cases}$$

The fuzzification process in the facility parameters obtained membership degrees as in table 3.

Table 3. Degree of Membership at Number of Facility

No	Tourism Site Name	Number of Facility	Membership Degree (f)		
			Less	Enough	Good
1	Borobudur Temple	2	1	0	0
2	Bandengan Beach	18	0	0.2	0.8
3	Kartini Beach	12	0	0.8	0.2
4	Empu Rancak Beach	11	0	0.9	0.1
5	Menganti Beach	7	0.6	0.4	0
6	Kartini Museum	6	0.8	0.2	0
7	Mantingan Mosque	1	1	0	0
8	Hian Thian Siang Tee Pagoda	1	1	0	0
9	Cinta Hill	2	1	0	0
10	Ranjeng Lake	1	1	0	0

4.3. Number of Visitor

From table 1 above, fuzzification is performed using number of visitor parameter membership function which divides it into 3 criteria, namely Little, Normal and Many.

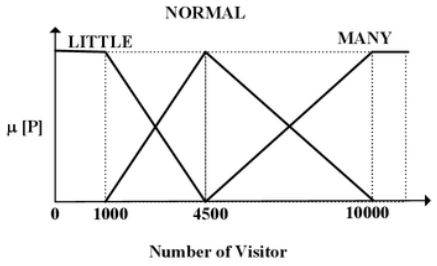

Figure 4. Membership Function Curve of Number of Visitor

Membership function at facility parameter :

$$\mu LittleVisitor[p] = \begin{cases} 1 & \rightarrow \quad p < 1000 \\ \frac{4500-p}{3.500} & \rightarrow \quad 1000 \leq p < 4500 \\ 0 & \rightarrow \quad p \geq 4500 \end{cases}$$

$$\mu NormalVisitor[p] = \begin{cases} 0 & \rightarrow \quad p \geq 10.000 \text{ or } p < 1.000 \\ \frac{p-1.000}{3.500} & \rightarrow \quad 1.000 \leq p < 4.500 \\ \frac{10.000-p}{5.500} & \rightarrow \quad 4.500 \leq p < 10.000 \end{cases}$$

$$\mu ManyVisitor[p] = \begin{cases} 0 & \rightarrow \quad p < 4.500 \\ \frac{p-4.500}{5.500} & \rightarrow \quad 4.500 \leq p < 10.000 \\ 1 & \rightarrow \quad p \geq 10.000 \end{cases}$$

The fuzzification process in the facility parameters obtained membership degrees as in table 4.

Tabel 4. Degree of Membership at Number of Visitor

No	Tourism Site Name	Number of Visitor per month	Membership Degree (p)		
			Little	Normal	Many
1	Borobudur Temple	3200	0.37	0.63	0
2	Bandengan Beach	4500	0	1	0
3	Kartini Beach	3450	0.30	0.70	0
4	Empu Rancak Beach	1403	0.88	0.11	0
5	Menganti Beach	1540	0.84	0.16	0
6	Kartini Museum	1670	0.80	0.20	0
7	Mantingan Mosque	7600	0	0.43	0.57
8	Hian Thian Siang Tee Pagoda	8600	0	0.25	0.75
9	Cinta Hill	1260	0.92	0.08	0
10	Ranjeng Lake	9540	0	0.08	0.92

4.4. Distance (Location of Tourism Site)

From table 1 above, fuzzification is performed using location of tourism site distance (from the capital of Central Java) parameter membership function which divides it into 3 intervals, namely Close, Enough and Far.

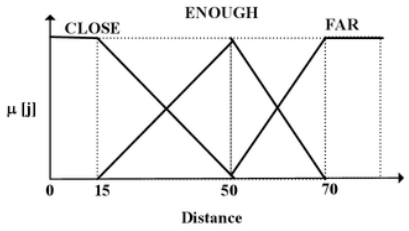

Figure 5. Membership Function Curve of Distance

Membership function at Distance Parameter

$$\mu CloseDistance[j] = \begin{cases} 1 & \rightarrow \quad j<15 \\ \frac{50-j}{15} & \rightarrow \quad 15 \leq j< 50 \\ 0 & \rightarrow \quad j \geq 50 \end{cases}$$

$$\mu EnoughDistance[j] = \begin{cases} 0 & \rightarrow \quad j< 15 \\ \frac{j-15}{15} & \rightarrow \quad 15 \leq j < 50 \\ \frac{70-j}{50} & \rightarrow \quad 50 \leq j \leq 70 \end{cases}$$

$$\mu FarDistance[j] = \begin{cases} 0 & \rightarrow \quad j<50 \\ \frac{j-50}{50} & \rightarrow \quad 50 \leq j < 70 \\ 1 & \rightarrow \quad j \geq 70 \end{cases}$$

The fuzzification process in the distance parameter obtained membership degrees as in table 5.

Table 5. Degree of Membership at Distance

No	Tourism Site Name	Distance (Km)	Membership Degree (j)		
			Close	Enough	Far
1	Borobudur Temple	150	0	0	1
2	Bandengan Beach	101	0	0	1
3	Kartini Beach	102	0	0	1
4	Empu Rancak Beach	105	0	0	1
5	Menganti Beach	185	0	0	1
6	Kartini Museum	110	0	0	1
7	Mantingan Mosque	112	0	0	1
8	Hian Thian Siang Tee Pagoda	105	0	0	1
9	Cinta Hill	15	1	0	0
10	Ranjeng Lake	210	0	0	1

The implementation of the data in table 1 for the selection of tourism site parameters based on the rules : Ticket prices "CHEAP", Facilities "ENOUGH", Number of visitors "NORMAL", Distance "FAR", which is executed by using Structure Query Language (SQL).

Calculation of fire strength is obtained from the degree of database membership. Each degree of membership that matches the query parameters is processed according to the rules or operators used, for example AND, OR or NOT. FireStrength as a result of operations with AND operators is obtained by taking the smallest membership value between elements in the corresponding sets, using the eq.1:

$$\mu CheapPrice \cap GoodFacilities \cap ManyVisitors$$
$$= \min\{\mu CheapPrice[h], \mu EnoughFacilities[f], \mu NormalVisitor[p], \mu FarDistance[i]\}$$

The results of fire strength calculations for each alternative are presented in table 6.

Table 6. Fire Strength Result

No	Tourism Site Name	Cheap Price	Enough Facilities	Normal Visitor	Far Distance	Fire Strength
1	Borobudur Temple	0	0	0.62	1	0
2	Bandengan Beach	1	0.2	1	1	0.2
3	Kartini Beach	1	0.8	0.7	1	0.7

4	Empu Rancak Beach	1	0.9	0.11	1	0.11
5	Menganti Beach	1	0.4	0.15	1	0.4
6	Kartini Museum	1	0.2	0.19	1	0.2
7	Mantingan Mosque	1	0	0.43	1	0
8	Hian Thian Siang Tee Pagoda	1	0	0.25	1	0
9	Cinta Hill	1	0	0.07	0	0
10	Ranjeng Lake	1	0	0.08	1	0

Search results on queries in the calculation of fire strength produce sequences or ranks of alternatives. Alternative tourism objects that have the highest fire strength value are Kartini Beach. This alternative is recommended as a tourist destination according to the calculation parameters used

CONCLUSION

Determination of alternative ranks in a decision making is obtained using the degree of membership of each parameter in a database. The fuzzy rules are integrated into the knowledgebase structured aims to make the stored data reusable. Fuzzy Tahani method can be implemented to help the decision maker to choose tourist attractions with various parameters such as consideration of ticket prices, tourist facilities, distance of tourist locations and the average visitor on tourist objects. This model is expected to make tourists satisfied in enjoying tourism activities and at the same time increase state revenue from the tourism sector.

REFERENCES

[1]. N. Moradi, M. Khoshnazar, A. Aryanpour, M.S. Namivandi, "Site Selection of Tourism Village in Mohabad Dam Shore Using AHP, GIS and SWOT Techniques", *Journal of Research and Rural Planning*, Vol.3(7), 2014, pp. 9-11.

[2]. Z. Montesa, F.M. Reza, M.M. Seddiq, P. Sharareh, G. Jamal, "Selection of The Optimal Tourism Site Using The AHP and Fuzzy TOPSIS in The Framework of Integrated Coastal Zone Management : A Case of Qeshm Island", *Ocean&Coastal Management, Elsevier*, Vol.130, 2016, pp.179-187.

[3]. N.A. Hadiwijaya, H. Hamdani, A. Syafrianto, Z. Tanjung, "The Decision Model for Selection of Tourism Site Using Analytic Network Process Model, *International Journal of Intelligent Systems and Applications*, Vol.10(9), 2018, pp.23-31.

[4]. M. Aruldoss, T.M. Lakshmi, V.P. Venkatesan, "A Survey on Multi Criteria Decision Making Methods and Its Applications", *American Journal of Information System*, Vol.1(1), 2013, pp. 31-43.

[5]. R. Guo, B. Liu, Z.Yang, "Research on Decision-making Effectiveness Factors of Top Management Team", *International Conference on Management Science & Engineering*, *IEEE*, 2011, pp. 348-354.

[6]. S. Chen, J. Liu, Y. Xu, J.C. Augusto, "A Linguistic Multi-Criteria Decision Making Approach Based on Logical Reasoning", *Information Sciences, Elsevier*, Vol. 258, 2014, pp. 266-276.

[7]. Z. Zhang and C. Guo, "An Approach to Group Decision Making with Heterogeneous Incomplete Uncertain Preference Relations", *Computer & Industrial Engineering, Elsevier*, Vol. 71, 2014, pp. 27-36.

[8]. W. Hadikurniawati and R. Wardoyo, "A Hybrid Multi-Attribute Decision Making For Electrician Seection Based on AHP, SAW and TOPSIS", *Journal of Theoretical and Applied Information Technology,* Vol. 77(1), 2016, pp. 136-142.

[9]. W. Hadikurniawati and K. Mustofa, "Multicriteria Group Decision Making Using Fuzzy Approach for Evaluating Criteria of Electrician", *International Journal of Electrical and Computer Engineering (IJECE)*, Vol 6(5), 2016, pp. 2462-2469.

[10]. W. Hadikurniawati and R. Wardoyo, "A Multi-Attribute Decision Making for Electician Selection using Triangular Fuzzy Numbers Arithmetic Approach", *International Journal of Advanced Computer Science and Applications*, Vol. 6(9), 2015, pp. 173-178.

[11].S. Wibowo, "A Fuzzy Multicriteria Group Decision Making Approach for Improving The Degree of Confidence in Supplier Selection", *Fourth International Symposium on Computational Intelligence and Design*, *IEEE*, 2011, pp. 83-86.

[12].Z. Wei, X. Wang, Q. Guo, "A Contractor Prequalification Model based on Triangular Fuzzy Number and TOPSIS", *IEEE*, 2011, pp. 1-4.

[13]. I. Bintoro, R, Malani, R. Rihartanto, "Modelling of Contractor Selection Using Fuzzy-TOPSIS", *5th International Conference on Electrical, Electronics and Information Engineering, IEEE*, 2017, pp. 140-145.

[14]. S.H. Sahir, R. Rosmawati, R. Rahim, "Fuzzy Model Tahani as A Decision Support System for Selection Computer Tablet", *International Journal of Engineering & Technology*, Vol. 7(2.9), 2018, pp. 61-63.

[15].D. Abdullah, H. Djanggih, S. Suendri, H. Cipta, N. Nofriadi, "Fuzzy Model Tahani as Decision Support System for Employee Promotion", *International Journal of Engineering & Technology*, Vol. 7(2.5), 2018, pp. 88-91.

Implementation of Tahani

ORIGINALITY REPORT

7%	1%	6%	1%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Wiwien Hadikurniawati, Edy Winarno, Aldy Hernawan, Dahlan Abdullah. "Optimization of ISP Service Maintenance Router Using Dijkstra and Flyod-Warshall Algorithm", Journal of Physics: Conference Series, 2018 Publication	2%
2	Rizaldi, Dewi Anggraeni, Robbi Rahim, Arridha Zikra Syah, Yessica Siagian. "Decision Support System For Formula Milk Selection Based On Nutrition Value Using Tahani Model Database Fuzzy Method", Journal of Physics: Conference Series, 2018 Publication	2%
3	Jian Ma, Quan Zhang, Zhiping Fan, Jiazhi Liang, Duanning Zhou. "An approach to multiple attribute decision making based on preference information on alternatives", Proceedings of the 34th Annual Hawaii International Conference on System Sciences, 2001 Publication	1%

4	Putri harliana, Robbi Rahim. "Comparative Analysis of Membership Function on Mamdani Fuzzy Inference System for Decision Making", Journal of Physics: Conference Series, 2017 Publication	1%
5	Ibayasid Bintoro, Rheo Malani, Rihartanto. "Modelling of contractor selection using fuzzy-TOPSIS", 2017 5th International Conference on Electrical, Electronics and Information Engineering (ICEEIE), 2017 Publication	1%
6	Submitted to Politeknik Negeri Sriwijaya Student Paper	1%
7	www.acit2k.org Internet Source	1%

Exclude quotes	Off	Exclude matches	< 1%
Exclude bibliography	On		