



PROCEEDINGS

The 1st International Basic Science Conference 2016
TOWARDS THE EXTENDED USE OF BASIC SCIENCE
FOR ENHANCING HEALTH, ENVIRONMENT,
ENERGY, AND BIOTECHNOLOGY

University of Jember, September 26 - 27, 2016



The 1st International Basic Science Conference 2016

(The 1st IBSC 2016)

“Towards the extended use of basic science for enhancing health, environment, energy and biotechnology”



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Preface

A Conference on the extended use of Basic Science was hosted by the Faculty of Mathematics and Natural Science (FMIPA), at CDAST building, Universitas Jember in 26-27th day of September 2016. This conference is intended to promote further developments of basic science for their tangible applications, especially health, environment, energy and biotechnology.

The conference posed the question “what biological, chemical, physical, geological, mathematical, statistical, medical, agricultural and other basic science field changes must be made in order to ensure better live quality in term of health, environment, energy and biotechnology. FMIPA was fortunate to welcome researchers, educators and engineers from various backgrounds representing a variety ways to extend the application of basic science in which safety, environmental friendly and energy efficiency were being pursued. More than two hundred contributors from fifty five different institutions presented the theory, methodology and application of the field and thus the 1st IBSC 2016 was very rich as the proceeding in this volume.

The major theme that emerged from the conference which was conducted by Faculty of Mathematics and Natural Science, Universitas Jember, and The Ministry of Technology and Higher Education (KEMENRISTEKDIKTI), Republic of Indonesia, was that basic science must extend in very fundamental way if high live quality is to become a stable standard of health, environment, energy and biotechnology. Ramkrishna Ramaswamy in his very inspiring talk, present the complexity and simplicity in biological systems; while Agus Salim discussed the big data of biostatistics with stressing on the quantity does not equal quality; Manabu Abe report the design and synthesis of a new Cromophore, and Bambang Sugiharto address the regularisation of sucrose-phosphate synthesis from sugarcane, and many more expert discus the application of basic science for improving live quality.

Having introduced the 1st IBSC 2016, we will introduce the 2nd Conference of basic science (The 2nd IBSC) in near future. This collaboration and link will be maintain. Hand in hand researcher, expert, educator and other professional in basic science is needed to improve live quality.

Jember January 26, 2017

Agung Tjahjo Nugroho

The Chairman of The 1st IBSC

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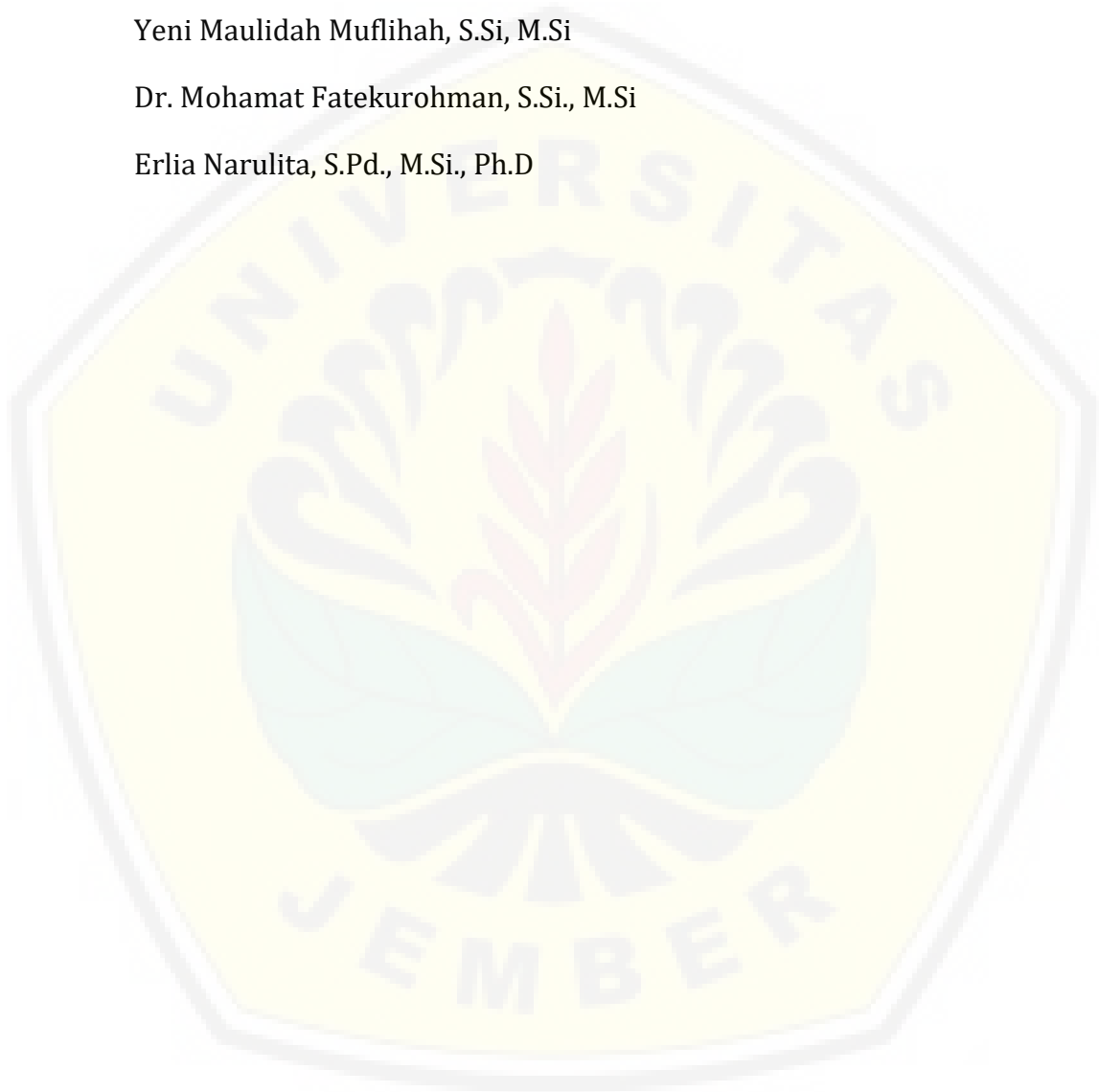


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Application of Fuzzy TOPSIS Method in Scholarship Interview

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Abstract—Decision-making problem is the process of determines the best options of all feasible alternative. In some problems, decision-making process involves the attributes of linguistic as in scholarship interview, which is one of the multi-objective decision-making (MODM) problem. The aim of this paper is to apply Fuzzy TOPSIS method in scholarship interview. Scholarship Interview that defined in this paper was implemented to m candidates by n questions for each candidate and assessed by p interviewers. Technique for the Order of Preference by Similarity to Ideal Solution (TOPSIS) method is a multi-attribute decision-making (MADM) method. The basic principle of the TOPSIS method is to choose the alternative that has similarity with the ideal solution. So that the TOPSIS method can be applied in a scholarship interview, in the first step is used fuzzy method to reduce the p -dimensional objective space to be one-dimensional objective space. Then applied the TOPSIS steps by fuzzy approaching to find the best alternative. In this paper will be used a scholarship interview case to illustrate more obviously steps. With this approach, the determination of the scholarship recipients can be more powerful and assured.

Keywords—Fuzzy, TOPSIS, Multi-objective decision-making, Scholarship Interview.

INTRODUCTION

Recently, along with the funds a scholarship offered by the foundation or government in Indonesia is very large and can be easily accessed by anyone. Increased number of applicants scholarship to continue his studies. Although a quota of scholarships offered are many, but the scholarship givers must remain rigorous in doing the selection. In order for the grant of scholarships can be directly proportional to the increase in the quality of human resources that are sanctioned. Scholarship selection is done in several stages, the last stage is the interview process. Scholarship interview is included in the determination of the issue of the decision of the multi purpose. In practice, in addition to the subjective nature of the assessment in the interview, scholarship also involves a linguistic variable such as "fair", "good", "very good", etc. So the needed methods that can properly solve the problem of determining the decisions on multi wawancaa scholarships. In this paper fuzzy topsis method will be applied to mementukan for candidates the best scholarship recipients in stages based on the assessment interview interviewer against each candidate's answer to the question that was specified earlier.

METHODS

a. TOPSIS Method

TOPSIS is a technique to sort the available alternatives based on its similarity to an ideal solution. TOPSIS introduced by Kwangsun Yoon and Hwang Ching-Lai in 1980. Principle basis of TOPSIS method is to choose the alternative that has the shortest distance to the positive ideal solution and the farthest distance from the negative ideal solution. With the goal even though the chosen alternative is not a positive ideal solution, but the solution chosen is a solution that is as close as possible to the positive ideal solution. Because it is in real life is very difficult to obtain a positive ideal solution.

Suppose there are m decision and n criteria, the value of the destination decision on criteria j -th is $x_j = [x_{1j} \ x_{2j} \ \dots \ x_{mj}]^T$, $1 \leq j \leq n$. So the decision matrix X can be obtained as follows:

$$X = \begin{bmatrix} x_{11} & x_{12} & \dots & x_{1n} \\ x_{21} & x_{22} & \dots & x_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ x_{m1} & x_{m2} & \dots & x_{mn} \end{bmatrix}. \quad (1)$$

The steps in TOPSIS method is as follows.

1) Normalized decision matrix

For maximizing problem, normalization can be done using Equation 2, $1 \leq i \leq m$,

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^m x_{ij}^2}}. \quad (2)$$

While for minimizing problem, use equation

$$r_{ij} = \frac{-x_{ij}}{\sqrt{\sum_{i=1}^m x_{ij}^2}}. \quad (3)$$

So the retrieved results matrix the normalization of R , i.e.

$$R = \begin{bmatrix} r_{11} & r_{12} & \dots & r_{1n} \\ r_{21} & r_{22} & \dots & r_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ r_{m1} & r_{m2} & \dots & r_{mn} \end{bmatrix}. \quad (4)$$

2) Determine the ideal point

Positive ideal point denoted by r^+ , while the negative ideal point denoted by r^- . Positive and negative ideal point respectively defined by the

$$r^+ = [r_1^+ \ r_2^+ \ \dots \ r_n^+]^T, \quad (5)$$

$$r^- = [r_1^- \ r_2^- \ \dots \ r_n^-]^T. \quad (6)$$

Where

$$r_j^+ = \max_i \{r_{ij}\},$$

$$r_j^- = \min_i \{r_{ij}\}.$$

3) Calculate the distance

The distance from i -th goal against the positive ideal point r^+ defined by

$$d_i^+ = \sqrt{\sum_{j=1}^n (r_{ij} - r_j^+)^2} \quad (7)$$

While the distance to the i -th goal to the negative ideal point r^- defined

$$d_i^- = \sqrt{\sum_{j=1}^n (r_{ij} - r_j^-)^2} \quad (8)$$

4) Calculate the approach degree

The relative approach degree to the i -th destination to the positive ideal point defined by

$$C_i = \frac{d_i^-}{d_i^+ + d_i^-} \quad (9)$$

5) Gives the ranking order of preference

Every goal can be ranked by descending order of C_i .

b. Fuzzy System

Problems in real life almost always associated with uncertainty, which can be expressed in linguistic variables "older", "too hot", "handsome", etc. Likewise, in MODM kesubjektifan and there are many uncertainties. To declare subjectiveness and uncertainties during the interview process, the weight of the question and the value of using variable lingistik and represented by triangular fuzzy numbers. A triangular fuzzy numbers is a convex fuzzy set, often expressed as the triple $\tilde{A} = (a, b, c)$, with membership functions defined by

$$\mu_{\tilde{A}}(x) = \begin{cases} 0 & , x < a \\ \frac{x-a}{b-a} & , a \leq x < b \\ \frac{c-x}{c-b} & , b \leq x \leq c \\ 0 & , x > c \end{cases}$$

Where b is middle value, a is upper value, and c is lower value from fuzzy number \tilde{A} . So that $\mu_{\tilde{A}}(x) = 0$ if $x = a$ or $x = c$, and $\mu_{\tilde{A}}(x) = 1$ if $x = b$.

Operations of addition, multiplication, division and Euler distance to the fuzzy numbers $\tilde{A}_1 = (a_1, b_1, c_1)$ and $\tilde{A}_2 = (a_2, b_2, c_2)$ defined by,

- 1) Addition: $\tilde{A}_1 + \tilde{A}_2 = (a_1 + a_2, b_1 + b_2, c_1 + c_2)$,
- 2) Multiplication: $\tilde{A}_1 \times \tilde{A}_2 = (a_1 \times a_2, b_1 \times b_2, c_1 \times c_2)$,
- 3) Division: $\frac{\tilde{A}_1}{\tilde{A}_2} = \left(\frac{a_1}{a_2}, \frac{b_1}{b_2}, \frac{c_1}{c_2}\right)$,
- 4) Euler Distance:

$$d(\tilde{A}_1, \tilde{A}_2) = \sqrt{\frac{1}{3}[(a_1 - a_2)^2 + (b_1 - b_2)^2 + (c_1 - c_2)^2]}.$$

In an interview scholarship in general, each candidate answers will be assessed by a number between 0 and 100. Also each of the questions will be weighted between 0% and 100%. In this paper, every answer will be rated using the linguistic variables “very bad”, “bad”, “bad enough”, “medium”, “good enough”, “good” or “excellent”. While each of the questions will be weighted by linguistic variables “very not important”, “not important”, “not important enough”, “medium”, “important enough”, “important” or “very important”. So as to obtain a triangular fuzzy numbers in Table 1 and Table 2.

Table 1. Fuzzy Numbers of Answer Score

Linguistic Variable	Fuzzy Number
Very bad	(0, 0, 10)
Bad	(0, 10, 30)
Bad enough	(10, 30, 50)
Medium	(30, 50, 70)
Good enough	(50, 70, 90)
Good	(70, 90, 100)
Excellent	(90, 100, 100)

Table 2. Fuzzy Number of Question Weight

Linguistic Variable	Fuzzy Number
Very not important	(0, 0, 0.1)
Not important	(0, 0.1, 0.3)
Not important enough	(0.1, 0.3, 0.5)
Medium	(0.3, 0.5, 0.7)
Important enough	(0.5, 0.7, 0.9)
Important	(0.7, 0.9, 1.0)
Very Important	(0.9, 1.0, 1.0)

Figures of membership degree, $\mu_{\tilde{A}}(x)$, fuzzy number of answer score and question weight is shown in Figure 1 and Figure 2.

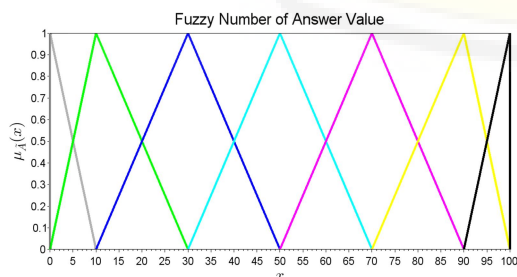


Fig 1. Membership Degree Of Answer Score

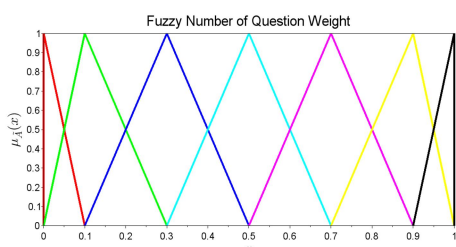


Fig 2. Membership Degree Of Question Weight

c. Fuzzy TOPSIS Method

1. Build a decision matrix

Suppose that in an interview scholarship candidates are m , n questions, and p interviewers. The scores given by the k -th interviewer to i -th candidate's answer for j -th question is denoted by \tilde{x}_{ij}^k , where $1 \leq i \leq m, 1 \leq j \leq n, 1 \leq k \leq p$. So as to obtain a decision matrix of the k -th interviewer, i.e.

$$\tilde{X}^k = \begin{bmatrix} \tilde{x}_{11}^k & \tilde{x}_{12}^k & \dots & \tilde{x}_{1n}^k \\ \tilde{x}_{21}^k & \tilde{x}_{22}^k & \dots & \tilde{x}_{2n}^k \\ \vdots & \vdots & \ddots & \vdots \\ \tilde{x}_{m1}^k & \tilde{x}_{m2}^k & \dots & \tilde{x}_{mn}^k \end{bmatrix} \quad (10)$$

Defined $\tilde{x}_{ij} = \frac{1}{p}(\tilde{x}_{ij}^1 + \tilde{x}_{ij}^2 + \dots + \tilde{x}_{ij}^p)$, so that it can be obtained a decision matrix \tilde{X} .

$$\tilde{X} = \begin{bmatrix} \tilde{x}_{11} & \tilde{x}_{12} & \dots & \tilde{x}_{1n} \\ \tilde{x}_{21} & \tilde{x}_{22} & \dots & \tilde{x}_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ \tilde{x}_{m1} & \tilde{x}_{m2} & \dots & \tilde{x}_{mn} \end{bmatrix} \quad (11)$$

1. Normalized decision matrix

Normalization done using equation

$$\tilde{r}_{ij} = \frac{\tilde{x}_{ij} - \min_i(\tilde{x}_{ij})}{\max_i(\tilde{x}_{ij}) - \min_i(\tilde{x}_{ij})} \quad (12)$$

So obtained normal decision matrix \tilde{R} .

$$\tilde{R} = \begin{bmatrix} \tilde{r}_{11} & \tilde{r}_{12} & \dots & \tilde{r}_{1n} \\ \tilde{r}_{21} & \tilde{r}_{22} & \dots & \tilde{r}_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ \tilde{r}_{m1} & \tilde{r}_{m2} & \dots & \tilde{r}_{mn} \end{bmatrix} \quad (13)$$

2. Weighted the normal decision matrix

If $\tilde{W}^k = [\tilde{w}_1^k \ \tilde{w}_2^k \ \dots \ \tilde{w}_n^k]^T$ is a vector weight for n question provided by k -th interviewer, defined

$$\tilde{w}_j = \frac{1}{p}(\tilde{w}_j^1 + \tilde{w}_j^2 + \dots + \tilde{w}_j^p), \quad (14)$$

can be obtained from the question weight vector, i.e.

$$\tilde{W} = [\tilde{w}_1 \ \tilde{w}_2 \ \dots \ \tilde{w}_n]^T. \quad (15)$$

Then defined $\tilde{u}_{ij} = \tilde{w}_j \times \tilde{r}_{ij}$, to obtain normal weighted decision matrix \tilde{U} .

$$\tilde{U} = \begin{bmatrix} \tilde{u}_{11} & \tilde{u}_{12} & \dots & \tilde{u}_{1n} \\ \tilde{u}_{21} & \tilde{u}_{22} & \dots & \tilde{u}_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ \tilde{u}_{m1} & \tilde{u}_{m2} & \dots & \tilde{u}_{mn} \end{bmatrix} \quad (16)$$

3. Determine the weighted ideal point

Positive ideal point \tilde{r}^+ and negative ideal point \tilde{r}^- from normal decision matrix \tilde{R} are

$$\begin{aligned} \tilde{r}^+ &= [\tilde{r}_1^+ \ \tilde{r}_2^+ \ \dots \ \tilde{r}_n^+]^T \\ &= [(1, 1, 1) \ (1, 1, 1) \ \dots \ (1, 1, 1)]^T, \end{aligned}$$

$$\begin{aligned} \tilde{r}^- &= [\tilde{r}_1^- \ \tilde{r}_2^- \ \dots \ \tilde{r}_n^-]^T \\ &= [(0, 0, 0) \ (0, 0, 0) \ \dots \ (0, 0, 0)]^T. \end{aligned}$$

So the weighted positive ideal point \tilde{u}^+ and weighted negative ideal point \tilde{u}^- can be defined by

$$\begin{aligned} \tilde{u}^+ &= [\tilde{u}_1^+ \ \tilde{u}_2^+ \ \dots \ \tilde{u}_n^+]^T \\ &= [\tilde{w}_1 \times \tilde{r}_1^+ \ \tilde{w}_2 \times \tilde{r}_2^+ \ \dots \ \tilde{w}_n \times \tilde{r}_n^+]^T \\ &= [\tilde{w}_1 \ \tilde{w}_2 \ \dots \ \tilde{w}_n]^T \\ &= \tilde{W} \end{aligned} \quad (17)$$

$$\begin{aligned} \tilde{u}^- &= [\tilde{u}_1^- \ \tilde{u}_2^- \ \dots \ \tilde{u}_n^-]^T \\ &= [\tilde{w}_1 \times \tilde{r}_1^- \ \tilde{w}_2 \times \tilde{r}_2^- \ \dots \ \tilde{w}_n \times \tilde{r}_n^-]^T \\ &= [(0, 0, 0) \ (0, 0, 0) \ \dots \ (0, 0, 0)]^T. \end{aligned} \quad (18)$$

4. Calculate distance

Using the definition of euler distance, the distance i -th candidate to weighted positive ideal point \tilde{u}^+ and weighted negative ideal point \tilde{u}^- , respectively, defined as \tilde{D}_i^+ dan \tilde{D}_i^- .

$$\tilde{D}_i^+ = \tilde{D}(\tilde{u}^+, \tilde{u}_i) = \sqrt{\sum_{j=1}^n [\tilde{d}(\tilde{u}_j^+, \tilde{u}_{ij})]^2}, \quad (19)$$

$$\tilde{D}_i^- = \tilde{D}(\tilde{u}^-, \tilde{u}_i) = \sqrt{\sum_{j=1}^n [\tilde{d}(\tilde{u}_j^-, \tilde{u}_{ij})]^2}. \quad (20)$$

5. Calculate the approach degree
 Afterward can be calculated degree of relative approach i -th candidates to weighted ideal point.

$$\tilde{C}_i = \frac{\bar{D}_i^-}{\bar{D}_i^+ + \bar{D}_i^-} \quad (21)$$

6. Gives the ranking order of preference
 Each candidate ranked by approach degrees \tilde{C}_i . Candidates with largest \tilde{C}_i will be given the first place, which means the most recommended to get a scholarship.

RESULTS

Scholarship interview process followed by 6 candidates, that is $C1, C2, C3, C4, C5,$ and $C6$. Each candidate gets same questions, questions is like in Table 3. Assessment by 3 interviewer ($I1, I2, I3$) that already has expertise in assessing the answer candidates.

Table 3. Scholarship Interview Questions

Q1	Tell us about yourself!
Q2	What is your greatest strength and weakness?
Q3	Where do you see yourself in ten years?
Q4	With what activities are you most involved?
Q5	What makes you special to receive this scholarship?

The interviewer will first give weight to each question. In accordance with the linguistic variable weighting questions in Table 2, the interviewer gives weight questions such as in Table 4.

Table 4. Question Weight from Interviewers

	Q1	Q2	Q3	Q4	Q5
I1	Very important	Important	Medium	Important	Not important
I2	Important	Very important	Not important enough	Medium	Important
I3	Important enough	Important	Very important	Not important	Medium

If the linguistic variables in Table 4 is converted into fuzzy numbers accordance with Table 2, it will obtain $\tilde{W}^1, \tilde{W}^2,$ dan \tilde{W}^3 .

$$\tilde{W}^1 = \begin{bmatrix} (0.9, 1.0, 1.0) \\ (0.7, 0.9, 1.0) \\ (0.3, 0.5, 0.7) \\ (0.7, 0.9, 1.0) \\ (0.0, 0.1, 0.3) \end{bmatrix},$$

$$\tilde{W}^2 = \begin{bmatrix} (0.7, 0.9, 1.0) \\ (0.9, 1.0, 1.0) \\ (0.1, 0.3, 0.5) \\ (0.3, 0.5, 0.7) \\ (0.7, 0.9, 1.0) \end{bmatrix},$$

$$\tilde{W}^3 = \begin{bmatrix} (0.5, 0.7, 0.9) \\ (0.7, 0.9, 1.0) \\ (0.9, 1.0, 1.0) \\ (0.0, 0.1, 0.3) \\ (0.3, 0.5, 0.7) \end{bmatrix}.$$

Therefore, by using Equation 14 is obtained weight vector

$$\tilde{W} = \begin{bmatrix} (0.70, 0.87, 0.97) \\ (0.77, 0.93, 1.00) \\ (0.43, 0.60, 0.73) \\ (0.33, 0.50, 0.67) \\ (0.33, 0.50, 0.67) \end{bmatrix}.$$

The third assessment by the interviewer to answer the candidates are presented in Table 5, Table 6 and Table 7.

Table 5. Score from First Interviewer

	Q1	Q2	Q3	Q4	Q5
C1	Very bad	Bad	Excellent	Excellent	Excellent
C2	Bad	Good enough	Good enough	Good	Very bad

C3	Bad enough	Excellent	Bad	Good enough	Excellent
C4	Medium	Excellent	Very bad	Medium	Very bad
C5	Good enough	Good	Medium	Bad enough	Medium
C6	Good	Medium	Good	Bad	Good

Table 6. Score from Second Interviewer

	Q1	Q2	Q3	Q4	Q5
C1	Bad	Bad	Excellent	Excellent	Medium
C2	Bad enough	Medium	Good enough	Excellent	Bad
C3	Medium	Good	Bad enough	Good	Medium
C4	Medium	Good	Bad	Good	Medium
C5	Good enough	Good enough	Medium	Good	Good
C6	Good	Medium	Good	Medium	Good enough

Table 7. Score from Third Interviewer

	Q1	Q2	Q3	Q4	Q5
C1	Bad enough	Bad enough	Excellent	Excellent	Medium
C2	Medium	Good enough	Good enough	Good	Good
C3	Good enough	Excellent	Medium	Good	Good enough
C4	Good enough	Excellent	Bad enough	Good enough	Medium
C5	Good	Good	Medium	Good enough	Bad
C6	Excellent	Good enough	good	Bad enough	Good enough

From the results of these assessments can be obtained by the decision matrix $\tilde{X}^1, \tilde{X}^2,$ and \tilde{X}^3 .

$$\tilde{X}^1 = \begin{bmatrix} (0, 0, 10) & (0, 10, 30) & (90, 100, 100) \\ (0, 10, 30) & (50, 70, 90) & (50, 70, 90) \\ (10, 30, 50) & (90, 100, 100) & (0, 10, 30) \\ (30, 50, 70) & (90, 100, 100) & (0, 0, 10) \\ (50, 70, 90) & (70, 90, 100) & (30, 50, 70) \\ (70, 90, 100) & (30, 50, 70) & (70, 90, 100) \\ (90, 100, 100) & (90, 100, 100) & \\ (70, 90, 100) & (10, 30, 50) & \\ (50, 70, 90) & (90, 100, 100) & \\ (30, 50, 70) & (0, 0, 10) & \\ (10, 30, 50) & (30, 50, 70) & \\ (0, 10, 30) & (70, 90, 100) & \end{bmatrix},$$

$$\tilde{X}^2 = \begin{bmatrix} (0, 10, 30) & (0, 10, 30) & (90, 100, 100) \\ (10, 30, 50) & (30, 50, 70) & (50, 70, 90) \\ (30, 50, 70) & (70, 90, 100) & (10, 30, 50) \\ (50, 70, 90) & (50, 70, 90) & (30, 50, 70) \\ (70, 90, 100) & (30, 50, 70) & (70, 90, 100) \\ (90, 100, 100) & (30, 50, 70) & \\ (90, 100, 100) & (0, 10, 30) & \\ (70, 90, 100) & (30, 50, 70) & \\ (70, 90, 100) & (30, 50, 70) & \\ (70, 90, 100) & (70, 90, 100) & \\ (30, 50, 70) & (50, 70, 90) & \end{bmatrix}.$$

$$\tilde{X}^3 = \begin{bmatrix} (10, 30, 50) & (10, 30, 50) & (90, 100, 100) \\ (30, 50, 70) & (50, 70, 90) & (50, 70, 90) \\ (50, 70, 90) & (90, 100, 100) & (30, 50, 70) \\ (50, 70, 90) & (90, 100, 100) & (10, 30, 50) \\ (70, 90, 100) & (70, 90, 100) & (30, 50, 70) \\ (90, 100, 100) & (50, 70, 90) & (70, 90, 100) \\ (90, 100, 100) & (30, 50, 70) & \\ (70, 90, 100) & (70, 90, 100) & \\ (70, 90, 100) & (50, 70, 90) & \\ (50, 70, 90) & (30, 50, 70) & \\ (50, 70, 90) & (0, 10, 30) & \\ (10, 30, 50) & (50, 70, 90) & \end{bmatrix}$$

So as to obtain a decision matrix \tilde{X} ,

$$\tilde{X} = \begin{bmatrix} (3.3, 13.3, 30) & (3.3, 16.7, 36.7) & (90, 100, 100) \\ (13.3, 30, 50) & (43.3, 63.3, 83.3) & (50, 70, 90) \\ (30, 50, 70) & (83.3, 96.7, 100) & (13.3, 30, 50) \\ (36.7, 56.7, 76.7) & (83.3, 96.7, 100) & (3.3, 13.3, 30) \\ (56.7, 76.7, 93.3) & (63.3, 83.3, 96.7) & (30, 50, 70) \\ (76.7, 93.3, 100) & (36.7, 56.7, 76.7) & (70, 90, 100) \\ (90, 100, 100) & (50, 66.7, 80) & \\ (76.7, 93.3, 100) & (26.7, 43.3, 60) & \\ (63.3, 83.3, 96.7) & (56.7, 73.3, 86.7) & \\ (50, 70, 86.7) & (20, 33.3, 50) & \\ (43.3, 63.3, 80) & (33.3, 50, 66.7) & \\ (13.3, 30, 50) & (56.7, 76.7, 93.3) & \end{bmatrix}$$

The next step is to normalize the decision matrix \tilde{X} , thus obtained normal decision matrix \tilde{R} ,

$$\tilde{R} = \begin{bmatrix} (0, 0, 0) & (0, 0.04, 0.1) & (1, 1, 1) \\ (0, 0, 0) & (0.47, 0.53, 0.67) & (0.58, 0.63, 0.8) \\ (0.24, 0.3, 0.4) & (1, 1, 1) & (0, 0, 0) \\ (0.42, 0.52, 0.67) & (1, 1, 1) & (0, 0, 0) \\ (0.8, 0.8, 0.89) & (1, 1, 1) & (0, 0, 0.11) \\ (1, 1, 1) & (0.37, 0.42, 0.53) & (0.89, 0.95, 1) \\ (1, 1, 1) & (0.54, 0.62, 0.71) & \\ (1, 1, 1) & (0.21, 0.21, 0.2) & \\ (0.71, 0.8, 0.93) & (0.62, 0.65, 0.73) & \\ (0.58, 0.68, 0.81) & (0.21, 0.24, 0.29) & \\ (0.4, 0.4, 0.44) & (0.1, 0, 0) & \\ (0, 0, 0) & (0.68, 0.74, 0.87) & \end{bmatrix}$$

By using the weighting matrix \tilde{W} and the decision matrix can normally be obtained normal weighted decision matrix \tilde{U} .

$$\tilde{U} = \begin{bmatrix} (0, 0, 0) & (0, 0.04, 0.1) & (0.43, 0.60, 0.73) \\ (0, 0, 0) & (0.36, 0.49, 0.67) & (0.25, 0.38, 0.59) \\ (0.17, 0.26, 0.39) & (0.77, 0.93, 1) & (0, 0, 0) \\ (0.29, 0.45, 0.64) & (0.77, 0.93, 1) & (0, 0, 0) \\ (0.56, 0.69, 0.86) & (0.77, 0.93, 1) & (0, 0, 0.08) \\ (0.7, 0.87, 0.97) & (0.28, 0.39, 0.53) & (0.39, 0.57, 0.73) \\ (0.33, 0.5, 0.67) & (0.18, 0.31, 0.48) & \\ (0.33, 0.50, 0.67) & (0.07, 0.11, 0.13) & \\ (0.24, 0.4, 0.62) & (0.21, 0.32, 0.49) & \\ (0.19, 0.34, 0.54) & (0.07, 0.12, 0.19) & \\ (0.13, 0.2, 0.3) & (0.03, 0, 0) & \\ (0, 0, 0) & (0.23, 0.37, 0.58) & \end{bmatrix}$$

By using Equation 19 and Equation 20 can be calculated distances \tilde{D}^+ and \tilde{D}^- .

$$\tilde{D}^+ = [1.223 \ 1.042 \ 0.851 \ 0.823 \ 0.834 \ 0.728]^T,$$

$$\tilde{D}^- = [0.867 \ 0.858 \ 1.110 \ 1.105 \ 1.175 \ 1.187]^T.$$

So as to obtain the approach degree by using Equation 21,

$$\tilde{C} = [0.415 \ 0.452 \ 0.566 \ 0.573 \ 0.585 \ 0.620]^T,$$

and seen that $\tilde{C}_6 > \tilde{C}_5 > \tilde{C}_4 > \tilde{C}_3 > \tilde{C}_2 > \tilde{C}_1$. In order to obtain such a rating in Table 8.

Table 8. Ranking from Scholarship Interview Result

Candidat	Ranking
C6	1
C5	2
C4	3
C3	4
C2	5
C1	6

So the most recommended candidates for scholarship was the candidate of the C6, and after that the recommended candidate is C5, and then follow the rankings that have been obtained.

CONCLUSION

Fuzzy TOPSIS method can be properly and effectively used to solve the problem MODM containing linguistic variables. This method is also quite simple, so easy to use.

On the issue of this scholarship interviews, with fuzzy TOPSIS method in the judging process of the candidates by the interviewer, the result that the candidate C6 has ranked first and most recommended to get a scholarship.

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