Analysis of the government district RMTDP using FMD and dematel method

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Abstract. Indonesia is one of the developing countries. Development is carried out in national, provincial, and district areas. Generally, development is done through a plan. Development planning consists of several strategic issues. These strategic issues describe the state of an area, specifically the area of a district. The purpose of this study is to analyze nine strategic issues of the Regional Medium-Term Development Plan (RMTDP) of the Government District in 2016-2021. Each strategic issue includes seven criterion values. Data from each strategic issue is collected using a questionnaire created by the institution. Data on these strategic issues are formulated in the form of a mathematical model, namely multiple criteria decision making (MCDM). Analysis of the MCDM data is performed using the Fuzzy Maximizing Deviation (FMD) and DEMATEL methods. The results of data analysis show that issues that should receive priority attention are still limited to basic environmental facilities and infrastructure, and the most dominant criteria for these nine issues are the tasks and responsibilities of the regional government.

1. Introduction
The Regional Medium-Term Development Plan (RMTDP) is a stage of the Regional Long-Term Development Plan (RPJPD) for the years 2005-2025. The RMTDP is determined by referring to the Long-term Development Plan and the district government Spatial Development Plan, the National Medium-Term Development Plan, the Provincial Responsibility Regional Development Plan, and the adjacent District Spatial Plan [1].

RMTDP was made for the district government's development plans and anticipated various development problems. Regional development problems arise due to a mismatch between the conditions and performance of development with the target development plan. Problems arise, among others, because the potential for empowerment is not optimal, and threats are not anticipated. The development plan is made from the results of the evaluation of program plans in the previous period, the results of the literature review and master plan of each field, the results of the evaluation of Minimum Service Standards, and the collection of potentials and problems from the regions of each Regional Apparatus involved in the implementation of regional development.

The purpose of the formulation of this development problem is to identify the factors of success and failure of development performance in the past; look for alternative strategies to overcome the potential problems that exist. Identification of development problems consists of problems in the fields of education, health, spatial planning and development plans, environment, resources, public housing, transportation, socio-economic and government. The results of the identification of development problems are formulated as strategic development issues in the next five years. Strategic issues are conditions that must receive attention in development planning because of their significant impacts on the region and society in the future. There are nine strategic issues in the government district, which are stated in Table 1. The determination of the strategic issues of the district government is done by considering seven criteria, which are stated in Table 1 [1].
The above problems can be considered as the MCDM problem. MCDM is the decision to find the best alternative from a number of alternatives based on certain criteria [2]. Methods for solving MCDM problems include topsis, vikor, and electre methods [2, 3, 4]. MCDM settlement methods include Fuzzy Maximizing Deviation (FMD) and Decision Making Trial and Evaluation Decision Laboratory (DEMATEL). The result of completing MCDM with FMD is finding selected alternatives. The alternative chosen is influenced by the criteria. The DEMATEL method is used to find the dominant criteria in the search for selected alternatives.

2 Method
This study aims to conduct an analysis of the 2016-2021 government district RMTDP consisting of nine strategic issues and seven criteria. Data were obtained from the Chairperson of the Housing and Settlement Sub-Division in the Regional Government Agency. Data formulation was carried out using a decision matrix stated in tabular form. Data table analysis is carried out using FMD to select critical strategic issues, which need to be addressed early. Then, using Dematel, the criteria that are most influential on the results of the selection of strategic issues are searched. An introduction to FMD and Dematel is as follows.

2.1 Fuzzy Maximizing Deviation
The FMD method is a method for dealing with MCDM problems with fuzzy and numerical information [2, 3, 4, 5]. According to Xu and Zhang [6], that building optimization models based on these methods is highly recommended for determining the optimal relative weights of attributes under an uncertain fuzzy environment. The FMD method works in a decision matrix consisting of a number of alternatives A and criteria C. The elements of the decision matrix are alternative preference values based on criteria, which can be expressed by triangular fuzzy numbers. The steps to complete MCDM by using FMD are as follows.

Step 1. Make the definition of a single valued neutrosophic.

**Definition 1** [7, 8, 9, 10]
Suppose X is a set of universes, a fuzzy set is defined as:

\[ A = \{(x, \mu_A(x))|x \in X\} \]  
(2.1)

where \( \mu_A(x) \) is the degree of membership \( x \) on set A.

**Definition 2** [9, 11]
A single valued neutrosophic (SVN) set A in X is

\[ A = \{(x, u_A(x), p_A(x), v_A(x))|x \in X\} \]  
(2.2)

where \( u_A : X \rightarrow [0,1] \), \( p_A : X \rightarrow [0,1] \), and \( v_A : X \rightarrow [0,1] \) with \( 0 \leq u_A + p_A + v_A \leq 3 \), \( \forall x \in X \). \( u_A(x) \), \( p_A(x) \), \( v_A(x) \) respectively stating the degree of correctness membership, the degree of uncertainty membership, and the degree of falsity membership x on A.

Step 2. Determine the single valued neutrosophic weighted average operator which involves the weights of attributes w and SVN, as follows [12, 13]:

For example \( \tilde{R} = (\tilde{r}_{ij})_{m \times n} = (u_{ij}, p_{ij}, v_{ij})_{m \times n} \) is the SVN decision matrix and \( \tilde{r}_i \) becomes a value attribute vector that corresponds to the alternative \( A_i \), \( i = 1, 2, ..., m \), then

\[ \tilde{r}_i = (u_{ij}, p_{ij}, v_{ij}) = SVNWA_w(\tilde{r}_{i1}, \tilde{r}_{i2}, ..., \tilde{r}_{in}) = (1 - \prod_{j=1}^{n}(1-u_{ij})^{w_j}, \prod_{j=1}^{n} p_{ij}^{w_j}, \prod_{j=1}^{n} v_{ij}^{w_j}) \]  
(2.3)
where $i = 1, 2, ..., m$ and $w = (w_1, w_2, ..., w_n)^T$ is the attribute weight vector and SVNWA is a single valued neutrosophic weighted average operator.

Step 3. Calculate cumulative $S$ scores for all SVN preference values by using the following equation [12, 13]

$$S(\tilde{r}) = \frac{14+u-2p-v}{2}, S(\tilde{r}) \in [-1, 1]$$  \hspace{1cm} (2.4)

Step 4. Ranking all alternative $A_i$ ($i = 1, 2, ..., m$) based on the cumulative score $S S(\tilde{r}_i)$.

2.2 Decision Making Trial and Evaluation Laboratory (DEMATEL)

DEMATEL can be used to solve complex and interrelated problems with the concept of measuring the level of influence of an object with other objects [14, 15]. DEMATEL is used to determine the relationship between the criteria of a variable. Representation of DEMATEL can be done with a matrix and diagram of cause and effect relationships [14]. DEMATEL is used to simplify complicated problems into structured causal relationships [16].

Steps to the DEMATEL Method [17, 18, 19, 20, 21, 22]

1. Determine the direct relationship matrix $(X)$, with five measurement scales, namely: 0 (no effect), 1 (small effect), 2 (moderate effect), 3 (large effect), and 4 (very large effect).

2. Direct relationship matrix entries $(X)$ are converted into fuzzy number scales which are then normalized into one crisp value by the Converting Fuzzy data into Crips Scores (CFCS) method or conversion of fuzzy data to crisp scores. The CFCS steps are as follows [14]:

   Step 1: Normalization
   $$x_{r_{ij}}^n = (r_{ij}^n - \min l_{ij}^n) / \Delta_{\max}$$
   $$x_{m_{ij}}^n = (m_{ij}^n - \min l_{ij}^n) / \Delta_{\min}$$
   $$x_{l_{ij}}^n = (l_{ij}^n - \min l_{ij}^n) / \Delta_{\min}$$
   $$\Delta_{\max} = \max r_{ij}^n - \min l_{ij}^n$$

   Step 2: Calculate the right normalization values $(rs)$ and left $(rl)$
   $$x_{rs_{ij}}^n = x_{r_{ij}}^n / (1 + x_{r_{ij}}^n - x_{m_{ij}}^n)$$
   $$x_{ls_{ij}}^n = x_{m_{ij}}^n / (1 + x_{m_{ij}}^n - x_{l_{ij}}^n)$$

   Step 3: Calculate the normalized total crisp value
   $$x_{ij}^n = \frac{[x_{ls_{ij}}^n(1 - x_{ls_{ij}}^n) + x_{rs_{ij}}^n \times x_{rs_{ij}}^n]}{[1 - x_{ls_{ij}}^n + x_{rs_{ij}}^n]}$$

   Step 4: Calculate the value of crisis
   $$z_{ij}^n = \min l_{ij}^n + x_{ij}^n \times \Delta_{\min}$$  \hspace{1cm} (2.5)

3. Normalize the direct relationship matrix $(X)$ to the matrix $(Z)$ using the following equation:
   $$K = \frac{1}{\max_{1 \leq i \leq n} \sum_{j=1}^{n} x_{ij}}$$
   $$Z = K \cdot X$$  \hspace{1cm} (2.6)

   find the total-relation matrix $(M)$ using the equation as follows:
   $$M = Z(Z - I)^{-1}$$  \hspace{1cm} (2.7)

   where I is an identity matrix.

4. Make a causal diagram.

   $$M = [m_{ij}] \hspace{0.5cm} i, j = 1, 2, ..., n$$
\[ D = \left[ \sum_{j=1}^{n} m_{ij} \right]_{n \times 1} = [m_i]_{n \times 1} \]

\[ R = \left[ \sum_{i=1}^{n} m_{ij} \right]_{1 \times n} = [m_j]_{n \times 1} \]

(2.8)

where \( D \) shows the number of rows and \( R \) shows the number of columns. Then, a cause and effect graph can be obtained by mapping the dataset \((D + R, D - R)\), where the x-axis is \((D + R)\) and the y-axis is \((D - R)\).

3 Result and Discussion

Analysis of the long-term development plan is carried out by looking at two things, i) analysis of the strategic issues of the RMTDP, and ii) analysis of the criteria that most influence the strategic issues of the RMTDP.

3.1 Analysis of RMTDP Strategic Issue

The strategic issues of the RMTD were determined based on factors of development priority in the previous period. Strategic issues are determined based on the results of the literature review and master plan of the development sectors, evaluation of the Minimum Service Standards, the potential and regional problems of each Regional Apparatus. There are nine strategic issues presented in Table 1 below.

| Symbol | Strategy Issues |
|--------|-----------------|
| A₁     | Limited education and health guarantees for the community |
| A₂     | Still need poverty alleviation |
| A₃     | Basic facilities and infrastructure are still limited |
| A₄     | Not yet optimal handling of floods and droughts |
| A₅     | The performance and cooperation of the government in the implementation of public order and security has not been optimal |
| A₆     | The rural communities still need to be empowered |
| A₇     | Still needs to be improved economic competitiveness of superior products |
| A₈     | Food security and independence are not yet stable |
| A₉     | Pollution control The environment is not yet effective and the area of green open space is still limited |

The evaluation of the nine strategic issues was carried out using seven considerations in Table 2. The weighting value of each criterion was determined from the results of the district government questionnaire.

| Symbol | Criteria for each strategic issue | Weight |
|--------|-----------------------------------|--------|
| C₁     | Has a significant influence on achieving national development targets | 0.2199 |
| C₂     | It is the duty and responsibility of district governments | 0.0968 |
| C₃     | Having significant leverage on district development | 0.1102 |
| C₄     | is important, fundamental, and challenging | 0.1157 |
| C₅     | Has a large and broad impact on the region and the community if not immediately addressed | 0.2333 |
| C₆     | Is a problem of long-term development | 0.1029 |
| C₇     | Has the possibility or ease to manage | 0.1212 |
Criteria values for the nine strategic issues of the medium term development plan were obtained from the head of the Housing Planning section and are presented in table 3 below.

### Table 3. Criteria values for each strategic issue

|   | C1 | C2 | C3 | C4 | C5 | C6 | C7 |
|---|----|----|----|----|----|----|----|
| A1| 4  | 3  | 2  | 4  | 4  | 3  | 3  |
| A2| 4  | 4  | 3  | 4  | 4  | 4  | 4  |
| A3| 2  | 3  | 4  | 4  | 3  | 2  | 2  |
| A4| 4  | 4  | 4  | 4  | 3  | 3  | 4  |
| A5| 2  | 4  | 3  | 4  | 3  | 4  | 4  |
| A6| 3  | 3  | 4  | 3  | 3  | 3  | 4  |
| A7| 4  | 2  | 3  | 4  | 4  | 4  | 3  |
| A8| 2  | 4  | 2  | 3  | 2  | 2  | 2  |
| A9| 3  | 4  | 3  | 4  | 3  | 3  | 3  |

The values in Table 3 above will be converted into triangular fuzzy numbers so that the following Table 4 is obtained:

### Table 4. Fuzzy values of criteria for each strategic issue

|   | C1                      | C2                      | C3                      | C4                      | C5                      | C6                      | C7                      |
|---|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| A1| (0.75,1,1)              | (0.50,0.75,1)           | (0.25,0.50,0.75)        | (0.75,1,1)              | (0.75,1,1)              | (0.50,0.75,1)           | (0.50,0.75,1)           |
| A2| (0.75,1,1)              | (0.75,1,1)              | (0.50,0.75,1)           | (0.75,1,1)              | (0.75,1,1)              | (0.75,1,1)              | (0.75,1,1)              |
| A3| (0.25,0.50,0.75)        | (0.50,0.75,1)           | (0.75,1,1)              | (0.25,0.50,0.75)        | (0.25,0.50,0.75)        | (0.50,0.75,1)           | (0.25,0.50,0.75)        |
| A4| (0.75,1,1)              | (0.50,0.75,1)           | (0.75,1,1)              | (0.75,1,1)              | (0.75,1,1)              | (0.75,1,1)              | (0.75,1,1)              |
| A5| (0.25,0.50,0.75)        | (0.75,1,1)              | (0.75,1,1)              | (0.25,0.50,0.75)        | (0.75,1,1)              | (0.75,1,1)              | (0.25,0.50,0.75)        |
| A6| (0.50,0.75,1)           | (0.50,0.75,1)           | (0.75,1,1)              | (0.50,0.75,1)           | (0.75,1,1)              | (0.75,1,1)              | (0.75,1,1)              |
| A7| (0.75,1,1)              | (0.75,1,1)              | (0.75,1,1)              | (0.75,1,1)              | (0.75,1,1)              | (0.75,1,1)              | (0.75,1,1)              |
| A8| (0.25,0.50,0.75)        | (0.75,1,1)              | (0.75,1,1)              | (0.25,0.50,0.75)        | (0.75,1,1)              | (0.75,1,1)              | (0.25,0.50,0.75)        |
| A9| (0.50,0.75,1)           | (0.75,1,1)              | (0.75,1,1)              | (0.50,0.75,1)           | (0.75,1,1)              | (0.75,1,1)              | (0.50,0.75,1)           |

Then calculate the value of $\tilde{r}_i$ using equation 2.3 for the weight value

$w=(0.2199, 0.0968, 0.1102, 0.1157, 0.2333, 0.1029, 0.1212)$

to obtain the following results:

$\tilde{r}_1 = (0.6475, 0.8448, 0.9688)$
$\tilde{r}_2 = (0.7302, 0.9688, 1)$
$\tilde{r}_3 = (0.3872, 0.5852, 0.8199)$
$\tilde{r}_4 = (0.6296, 0.8495, 1)$
$\tilde{r}_5 = (0.5565, 0.7073, 0.8769)$
$\tilde{r}_6 = (0.6034, 0.8257, 1)$
$\tilde{r}_7 = (0.7281, 0.9657, 1)$
$\tilde{r}_8 = (0.4146, 0.6160, 0.8526)$
$\tilde{r}_9 = (0.5685, 0.7973, 1)$

After getting the overall value of $\tilde{r}_i$ then calculating the value of the score $S(\tilde{r}_i)$ using equation (2.4), the following results are obtained:

$S(\tilde{r}_1) = -0.5054$
$S(\tilde{r}_2) = -0.6037$
$S(\tilde{r}_3) = -0.3016$
$S(\tilde{r}_4) = -0.5347$
$S(\tilde{r}_5) = -0.3675$
$S(\tilde{r}_6) = -0.5240$
$S(\tilde{r}_7) = -0.6017$
$S(\tilde{r}_8) = -0.3350$
$S(\tilde{r}_9) = -0.5130$

The results of the ranking of the values $S(\tilde{r}_i)$ is $A_3 > A_8 > A_5 > A_1 > A_9 > A_6 > A_4 > A_7 > A_2$. This means that issues that have a strong influence on the emergence of problems in the fields of education, health, spatial planning and development planning, environment, water resources, public housing, transportation, social, economic, and government are still limited to basic environmental facilities and infrastructure ($A_3$).
3.2 Analysis of the most influential criteria of the RMTDP strategic issues

The analysis of the criteria that most influences the strategic issues of the RMTDP results from the value of the interrelationships between the criteria in Table 5. The values in Table 5 were obtained from the head of the Housing Planning section.

Table 5. Value of the interrelationship between the criteria

|     | C1  | C2  | C3  | C4  | C5  | C6  | C7  |
|-----|-----|-----|-----|-----|-----|-----|-----|
| C1  | -   | 4   | 4   | 4   | 4   | 3   | 3   |
| C2  | 3   | -   | 3   | 4   | 4   | 3   | 3   |
| C3  | 3   | 2   | -   | 4   | 3   | 3   | 3   |
| C4  | 4   | 2   | 2   | -   | 4   | 2   | 2   |
| C5  | 3   | 2   | 2   | 4   | -   | 3   | 2   |
| C6  | 3   | 2   | 2   | 2   | 2   | -   | 2   |
| C7  | 2   | 2   | 3   | 2   | 2   | 2   | -   |

After getting the value of the relationship between one criterion with other criteria, the next is to change the value of the relationship into the fuzzy number scale in accordance with Table 5, obtaining the following results:

Table 6. Fuzzy value of the interrelationship between the criteria

|     | C1          | C2          | C3          | C4          | C5          | C6          | C7          |
|-----|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| C1  | (0.75,1,1)  | (0.75,1,1)  | (0.75,1,1)  | (0.75,1,1)  | (0.5,0.75,1)| (0.5,0.75,1)| (0.5,0.75,1)|
| C2  | (0.5,0.75,1)| (0.5,0.75,1)| (0.5,0.75,1)| (0.5,0.75,1)| (0.5,0.75,1)| (0.5,0.75,1)| (0.5,0.75,1)|
| C3  | (0.5,0.75,1)| (0.25,0.5,0.75)| (0.75,1,1)| (0.5,0.75,1)| (0.75,1,1)| (0.5,0.75,1)| (0.5,0.75,1)|
| C4  | (0.75,1,1)| (0.25,0.5,0.75)| (0.25,0.5,0.75)| (0.75,1,1)| -           | (0.75,1,1)| (0.25,0.5,0.75)|
| C5  | (0.5,0.75,1)| (0.25,0.5,0.75)| (0.25,0.5,0.75)| (0.75,1,1)| -           | (0.75,1,1)| (0.25,0.5,0.75)|
| C6  | (0.5,0.75,1)| (0.25,0.5,0.75)| (0.25,0.5,0.75)| (0.25,0.5,0.75)| (0.25,0.5,0.75)| (0.25,0.5,0.75)| (0.25,0.5,0.75)|
| C7  | (0.25,0.5,0.75)| (0.25,0.5,0.75)| (0.5,0.75,1)| (0.25,0.5,0.75)| (0.25,0.5,0.75)| (0.25,0.5,0.75)| (0.25,0.5,0.75)|

The next step is to find the direct relationship matrix X using equations (2.5) and get Table 7.

Table 7. Direct Relationship Matrix

|     | C1  | C2  | C3  | C4  | C5  | C6  | C7  |
|-----|-----|-----|-----|-----|-----|-----|-----|
| C1  | 0   | 1.2 | 1.2 | 1.2 | 1.2 | 0.9 | 0.9 |
| C2  | 0.9 | 0   | 0.9 | 1.2 | 1.2 | 0.9 | 0.9 |
| C3  | 0.9 | 0.6 | 0   | 0.9 | 1.2 | 0.9 | 0.9 |
| C4  | 1.2 | 0.6 | 0.6 | 0   | 1.2 | 0.6 | 0.6 |
| C5  | 0.9 | 0.6 | 0.6 | 1.2 | 0   | 0.9 | 0.6 |
| C6  | 0.9 | 0.6 | 0.6 | 0.6 | 0.6 | 0   | 0.6 |
| C7  | 0.6 | 0.6 | 0.9 | 0.6 | 0.6 | 0.6 | 0   |

Normalizing the direct relationship matrix (X) using equations (2.6), will produce the following:

Table 8. Normalization of the Direct Relationship Matrix

|     | C1  | C2  | C3  | C4  | C5  | C6  | C7  |
|-----|-----|-----|-----|-----|-----|-----|-----|
| C1  | 0   | 0.1818 | 0.1818 | 0.1818 | 0.1818 | 0.1818 | 0.1364 | 0.1364 |
| C2  | 0.1364 | 0   | 0.1364 | 0.1818 | 0.1818 | 0.1818 | 0.1364 | 0.1364 |
| C3  | 0.1364 | 0.0909 | 0   | 0.1364 | 0.1818 | 0.1818 | 0.1364 | 0.1364 |
| C4  | 0.1818 | 0.0909 | 0.0909 | 0   | 0.1818 | 0.1818 | 0.1364 | 0.0909 |
| C5  | 0.1364 | 0.0909 | 0.0909 | 0.1818 | 0   | 0.1364 | 0.0909 | 0.0909 |
| C6  | 0.1364 | 0.0909 | 0.0909 | 0.0909 | 0.0909 | 0   | 0.0909 | 0.0909 |
| C7  | 0.0909 | 0.0909 | 0.1364 | 0.0909 | 0.0909 | 0.0909 | 0   | 0.0909 |
Calculating the total relation value (M) from the normalized direct relationship matrix (Z), using equation (2.7), will get the total relation value (M):

\[
\text{Table 9. Total Relationship Value}
\]

|     | C1   | C2   | C3   | C4   | C5   | C6   | C7   |
|-----|------|------|------|------|------|------|------|
| C1  | 0.5087 | 0.5582 | 0.6042 | 0.6893 | 0.7125 | 0.5736 | 0.5439 |
| C2  | 0.5839 | 0.3669 | 0.5283 | 0.6413 | 0.6616 | 0.5326 | 0.5050 |
| C3  | 0.5388 | 0.4165 | 0.3700 | 0.5593 | 0.6119 | 0.4941 | 0.4685 |
| C4  | 0.5440 | 0.3951 | 0.4286 | 0.4110 | 0.5813 | 0.4311 | 0.4068 |
| C5  | 0.5029 | 0.3868 | 0.4195 | 0.5545 | 0.4168 | 0.4585 | 0.3995 |
| C6  | 0.4393 | 0.3397 | 0.3685 | 0.4195 | 0.4336 | 0.2857 | 0.3509 |
| C7  | 0.3988 | 0.3337 | 0.4004 | 0.4140 | 0.4294 | 0.3657 | 0.2644 |

Make a causal diagram, by calculating D and R using equations (2.8), obtain the following results:

\[
\text{Table 10. Coordinate Value of Causal Diagram}
\]

|     | C1   | C2   | C3   | C4   | C5   | C6   | C7   |
|-----|------|------|------|------|------|------|------|
| D   | 4.1904 | 3.8196 | 3.4591 | 3.1979 | 3.1385 | 2.6372 | 2.6064 |
| R   | 3.5164 | 2.7969 | 3.1195 | 3.6889 | 3.8471 | 3.1413 | 2.9390 |
| D+R | 7.7068 | 6.6165 | 6.5786 | 6.8868 | 6.9856 | 5.7785 | 5.5454 |
| D-R | 0.6740 | 1.0227 | 0.3396 | -0.4910 | -0.7086 | -0.5041 | -0.3326 |

Then a cause and effect chart is obtained by mapping the dataset from (D + R, D - R), where x-axis (D + R) and y-axis (D - R). Based on calculations in the DEMATEL method and a causal diagram (Figure 1) shows that the highest criterion is the second criterion (C2) which means the duties and responsibilities of the regional government.

**Figure 1. Causal diagram**

**4 Conclusion**

Based on the discussion above, it can be concluded that the chosen alternative in the RMTDP on the assessment of the district government strategic issues is considered to have a strong influence on the emergence of problems in the fields of education, health, spatial planning and development planning,
environment, water resources, public housing, transportation, social, economy, and governance are still limited basic environmental facilities and infrastructure (third alternative) with the most dominant influence on the alternative criteria is the duties and responsibilities of the regional government (second criteria)

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References
[1] Arsip Dokumen Badan Perencanaan Pembangunan Daerah Kabupaten Bandung 2018
[2] Fahmi A and Amin F 2019 Triangular cubic linguistic uncertain fuzzy topsis method and application to group decision making Soft Computing 23 12221
[3] Ding X F and Liu H C 2019 An extended prospect theory–VIKOR approach for emergency decision making with 2-dimension uncertain linguistic information Soft Computing 23 12139
[4] Sitorus F, Cilliers J J and Parada P R B 2019 Multicriteria decision making for the choice problem in mining and mineral processing: Applications and trends Expert Systems With Applications 121 p 393
[5] Wang Y M 1997 Using The Method of Maximizing Deviations to Make Decision for Multi-Indices System Engineering and Electronics 8 p 21
[6] Xu Z and Zhang X 2013 Hesitant Fuzzy Multi-Attribute Decision Making Based on TOPSIS with Incomplete Weight Information Knowledge-Based Systems 52 p 53
[7] Zadeh L A 1965 Fuzzy Set Information and Control 8 p 338
[8] Joshi D and Kumar S 2016 Interval-valued intuitionistic hesitant fuzzy Choquet integral based TOPSIS method for multi-criteria group decision making European Journal of Operational Research 248 p 183
[9] Dadzie E A, Oplatkova Z K and Prieto L A B 2017 Comparative State-of-the-Art Survey of Classical Fuzzy Set and Intuitionistic Fuzzy Sets in Multi-Criteria Decision Making International Journal of Fuzzy Systems 19 p 726
[10] Broumi S, Talea M, Bakali A, Smarandache F, Nagarajan D, Lathamaheswari M and Parimala M 2019 Shortest path problem in fuzzy, intuitionistic fuzzy and neutrosophic environment: an overview Complex & Intelligent Systems 5 p 371
[11] Wang H, Smarandache F, Zhang Y Q and Sunderraman R 2010 Single Valued Neutrosophic Sets Multispaces and Multistructures pp 410-13
[12] Wei G W 2008 Maximizing Deviation Method for Multiple Attribute Decision Making in Intuitionistic Fuzzy Setting Knowledge-Based System 21 p 833
[13] Sahin R and Liu P 2016 Maximizing Deviation Method for Neutrosophic Multiple Attribute Decision Making with Incomplete Weight Information, Neural Computing and Application 27 p 2017
[14] Tzeng G H, Chiang C H and Li C W 2007 Evaluating Interwined Effect in E-learning Program: A Novel Hybrid MCDM Model Based on Factor Analysis and DEMATEL Expert System Application 32 p 1028
[15] Dytczak M and Ginda G 2013 Is Expert Processing of Fuzzy Direct Influence Evaluation in DEMATEL Indispensable?. Expert System with Application 40 p 5027
[16] Lin Y T, Yang Y H, Kang J S and Yu H C 2011 Using DEMATEL Method to Explore The Core Competences and Casual Effect of The IC Design Service Company: An Empirical Case Study. Expert System with Applications 38 p 6262
[17] Suresh K and Dillibabu R 2019 A novel fuzzy mechanism for risk assessment in software projects *Soft Computing* 1

[18] Zhang W and Deng Y 2019 Combining conflicting evidence using the DEMATEL method *Soft Computing* 23 p 8207

[19] Zhou X, Hu Y, Deng Y, Chan F T S and Ishizaka A 2018 A DEMATEL-based completion method for incomplete pairwise comparison matrix in AHP *Annals of Operations Research* 271 p 1045

[20] Alzahrani A I, Samarraie H A, Eldenfria A and Alalwan N 2018 A DEMATEL method in identifying design requirements for mobile environments: students’ perspectives *Journal of Computing in Higher Education* 30 p 466

[21] Han W, Sun Y, Xie H and Che Z 2018 Hesitant Fuzzy Linguistic Group DEMATEL Method with Multi-granular Evaluation Scales *International Journal of Fuzzy Systems* 20 p 2187

[22] Sangaiah A K, Gopal J, Basu A and Subramaniam P R 2017 An integrated fuzzy DEMATEL, TOPSIS, and ELECTRE approach for evaluating knowledge transfer effectiveness with reference to GSD project outcome *Neural Computing and Applications* 28 p 111