Supplementary Material

Article title: An integrated decision-making framework for selecting the best strategies of water resources management in pandemic emergencies (Ref. No SCI-2011-5077)

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A. Methodology

A.1. SWOT Analysis

SWOT analysis is a strategic planning technique, which is used to help an organization identify strengths, weaknesses, opportunities, and threats related to some candidate strategies. It is frequently designed to be used in the preliminary stages of decision-making processes and can be used as a tool for evaluation of the strategic position of a city or organization. In other words, the SWOT analysis is one of the strategic tools for matching the strengths and weaknesses within the system with the opportunities and threats outside the system. This model provides a systematic analysis to identify these factors and select the solution that best suits them. From this model's point of view, a good solution maximizes strengths and opportunities and minimizes weaknesses and threats. For this purpose, strengths and weaknesses, opportunities and threats are linked in four general modes: SO, WO, ST, WT, and strategic options are selected among them. To build a SWOT matrix, the threats, opportunities, weaknesses, and strengths, are identified using the assessment of the internal and external environments of the organizations with preparing some lists for each part. Also, some comparisons for obtaining effective solutions are done including: internal strengths and external opportunities (SO), internal weaknesses with external opportunities (WO), internal strengths with external threats (ST), internal weaknesses with external threats (WT). The general form of the SWOT matrix is shown in Figure A.1.

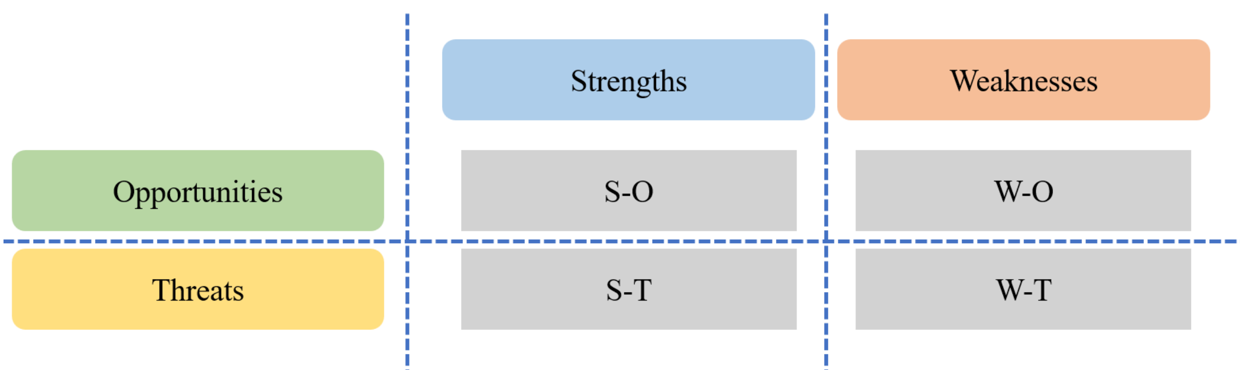

Figure A.1. SWOT Matrix

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As can be seen in Figure A.1, there are four types of strategies according to the SWOT approach:

• Strength-Opportunity Strategies (SO)

This is the most desirable and appropriate situation for the organization, and it means that the organization, while having the capabilities and strengths worthy and reliable, in its interactive environment and context, also faces appropriate and valuable opportunities. Therefore, these strategies describe how to use the existing capacity of the organization to make the most of the enormous environmental opportunities.

• Strengths - Threats (ST)

In this case, although the organization has reliable strengths and capabilities, but in its interactive environment and contexts, it also faces numerous and serious challenges and threats. Thus, these strategies outline how to maximize existing power to optimally deal with environmental pressures, challenges, and threats.

• Weakness-Opportunity Strategies (WO)

In this case, although there are many valuable opportunities for the organization in the environment, on the other hand, there are weaknesses, inefficiencies and serious vulnerabilities. Therefore, by using weakness-opportunity strategies, one should make every effort to compensate for one's weaknesses and disabilities by using environmental opportunities.

• Weaknesses - Threats (WT)

This illustrates the worst, most difficult, and most dangerous conditions for an organization to operate. This is because, despite its many weaknesses and inadequacies, it has to deal with a variety of pressures, challenges, and threats in its interactive environments or contexts. Therefore, using WT strategies, it tries to cover its weaknesses in some way, or minimize its vulnerabilities in terms of environmental threats, minimize them, or, if possible, protect itself from these bites and threats.

A.2. Fuzzy DEMATEL

Fuzzy DEMATEL examines the relationships between criteria and sub-criteria and identifies all the influential and influential criteria (or in other words, causal criteria) by the relationship matrix. This method is one of the multi-criteria decision-making methods. As the name implies, all calculations are performed in a fuzzy environment. However, assume $\tilde{a} = (l, m, u)$ is a triangular fuzzy number. The Graded Mean Integration Representation (GMIR),which is shown by $R(\tilde{a})$, is defined using Equation (A.1) below:

$$R(\tilde{a}) = \frac{l + 4m + u}{6} \tag{A.1}$$

The steps of FDEMATEL are as follows:

Step 1: Form a group of experts to gather their group knowledge to solve the problem. However, determining the criteria to be evaluated as well as the design of linguistic scales are in this step. In this research, we use linguistic scales which are given in Table A.1.

Table A.1. Transformation table of linguistic variables

Linguistic terms	Linguistic values	Triangular fuzzy numbers
No influence (No)	(1, 1, 1)	$\tilde{1}$
Very low influence (VL)	(2, 3, 4)	$\tilde{3}$
Low influence (L)	(4, 5, 6)	$\tilde{5}$
High influence (H)	(6, 7,8)	$\tilde{7}$
Very high influence (VH)	(8, 9,9)	$\tilde{9}$

Step 3: Create a fuzzy matrix with the initial direct relations by gathering expert opinions. To measure the relationships between criteria/sub-criteria, we need to put them in a matrix and ask experts to compare them in pairs based on how much they influence each other. In this survey, experts will express their views based on Table A.1. Assuming we have n criteria and p expertise; we have P numbers of fuzzy matrix ($n \times n$), each corresponding to the opinions of an expert with triangular fuzzy numbers. Finally, the average of these matrices is applied to calculations.

Step 4: Normalize fuzzy matrix of direct relations. To this, linear scale conversion is used as a normalization formula to convert scale to comparable scales using Equations (A.2 and A.3):

$$\tilde{a}_{ij} = \sum_{j=1}^{n} \tilde{Z}_{ij} = \left(\sum_{j=1}^{n} l_{ij}, \sum_{j=1}^{n} m_{ij}, \sum_{j=1}^{n} r_{ij}\right) \text{and } r = \max_{1 \le i \le n}\left(\sum_{j=1}^{n} r_{ij}\right) \quad (A.2)$$

$$\tilde{X} = \begin{bmatrix} \tilde{X}_{11} & \cdots & \tilde{X}_{1n} \\ \vdots & \ddots & \vdots \\ \tilde{X}_{m1} & \cdots & \tilde{X}_{mn} \end{bmatrix} \text{and } \tilde{X}_{ij} = \frac{\tilde{Z}_{ij}}{r} = \left(\frac{l_{ij}}{r}, \frac{m_{ij}}{r}, \frac{r_{ij}}{r}\right) \quad (A.3)$$

Step 5: Calculate the fuzzy matrix of total relations. In this step, we first calculate the inverse of the normal matrix and then subtract it from the matrix I, and finally multiply the normal matrix by the resulting matrix as Equations (A.4 - A.6).

$$\left[l''_{ij}\right] = X_l \times (1 - X_l)^{-1} \quad (A.4)$$

$$\left[m''_{ij}\right] = X_m \times (1 - X_m)^{-1} \quad (A.5)$$

$$\left[r''_{ij}\right] = X_r \times (1 - X_r)^{-1} \quad (A.6)$$

Step 6: Creation and analysis of causal diagram. To do this, we first calculate the sum of the elements of each row (D_i) and the sum of the elements of each column (R_i) of the fuzzy matrix above. D_i indicates the level that each factor affects the other factors in the system. Also, R_i indicates the effectiveness of each factor from the other factors. Consequently, $D + R$ and $D - R$ are calculated. More value of the $D + R$, results that this factor is more interactive with other system factors. On the other hand, if $D - R$ is positive, the variable is a causal variable, and if it is negative, it is not a cause. The causal diagram can be plot based on $D + R$ and $D - R$.

A.3. Fuzzy Best-Worst-Method

FBWM is one of the new multi-criteria decision-making methods. The basis of this method is to measure the criteria by comparing pairs. In the FBWM, the weight of the criteria is determined by determining the priority of the best criterion over other criteria and the preference of all criteria over the worst criterion. Advantages of this method compared to other multi-criteria decision- making methods are:

- Requires less comparative data;
- This method leads to more stable comparisons and provides more reliable answers.
- This approach can easily combine with the other MADM methods.

The steps of FBWM are as follows:

Step 1: Determining the Best and Worst (Most Important and Less Important): This step can be determined using expert opinions or a fuzzy Delphi method.

Step 2: Pair comparison of the best criterion with other criteria and other criteria with the worst criterion: In this step, pairwise comparison vectors with the following transformation in Table A.2.

Table A.2. Transformation table of linguistic variables

Linguistic terms	Membership function
Equally important (EI)	(1, 1, 1)
Weakly important (WI)	(0.667, 1, 1.5)
Fairly important (FI)	(1.5, 2, 2.5)
Very important (VI)	(2.5, 3, 3.5)
Absolutely important (AI)	(3.5, 4, 4.5)

Considering $\tilde{A}_W$ and $\tilde{A}_B$ are the comparison vectors of other-to-worst and Best-to-other as Equations (A.7 - A.8):

$$\tilde{A}_W = (\tilde{a}_{1W}, \tilde{a}_{2W}, \dots, \tilde{a}_{nW}) \quad \text{(A.7)}$$

$$\tilde{A}_B = (\tilde{a}_{B1}, \tilde{a}_{B2}, \dots, \tilde{a}_{Bn}) \quad \text{(A.8)}$$

Step 3: Creating a fuzzy BWM model: In this step, you can calculate the factors using the nonlinear under-weight planning model as Equation (A.9).

$$
\min \tilde{\xi}^{*}
$$

$$
s.t.\begin{cases}
\left| \dfrac{(l_B^w, m_B^w, u_B^w)}{(l_j^w, m_j^w, u_j^w)} - (l_{Bj}, m_{Bj}, u_{Bj}) \right| \le (k^*, k^*, k^*) \forall j \\
\left| \dfrac{(l_j^w, m_j^w, u_j^w)}{(l_W^w, m_W^w, u_W^w)} - (l_{jw}, m_{jw}, u_{jw}) \right| \le (k^*, k^*, k^*) \forall j \\
\sum_{j=1}^{n} R(\tilde{w}_j) = 1 \forall j \\
l_j^w \le m_j^w \le u_j^w \forall j \\
l_j^w \ge 0 \forall j
\end{cases} \tag{A.9}
$$

Step 4: In this method, after solving the model (9), a formula is used to calculate the Consistency Ratio (CR) in order to check the validity of the comparisons. First, based on the comparison vector of best-to-worst criteria, the Consistency Index (CI) is determined (according to Table A.3). Then, the consistency ratio calculated applying the Equation (A.10).

$$
CR = \frac{\xi^*}{CI} \tag{A.10}
$$

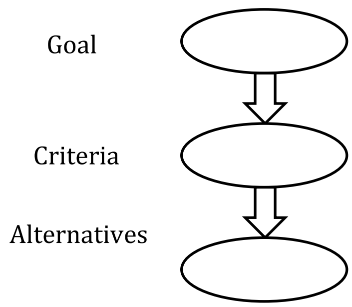
The smaller value for CR (close to zero) is better.

Table A.3. Consistency Index (CI)

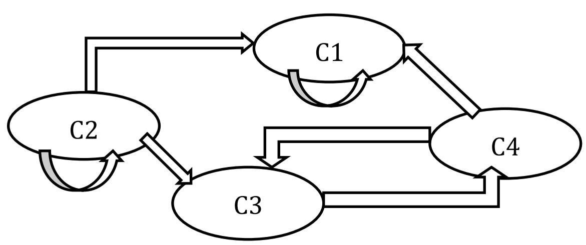
	(EI)	**(WI)**	**(FI)**	**(VI)**	**(AI)**
$\tilde{a}_{BW}$	(1, 1, 1)	(0.667, 1, 1.5)	(1.5, 2, 2.5)	(2.5, 3, 3.5)	(3.5, 4, 4.5)
CI	3.00	3.80	5.29	6.69	8.04

A.4. Fuzzy Analytical Network Process

The ANP method is one of the multi-attributes decision-making methods (MADM) which is similar to the AHP method but in which the criteria or sub-criteria or options have a dependence or relationship. In fact, the AHP method can be considered a special case of network technique. If there is a problem in which the criteria are related or the sub-criteria are internally related, this type of problem can no longer be done through the AHP method because the problem no longer goes out of the hierarchical state and creates a network state. In this case, the problem must be solved through the ANP method. In fact, the AHP method is considered a special case of the ANP method. The network analysis process provides a comprehensive and powerful method for making accurate decisions using the empirical information or personal judgments of each decision maker and by providing a structure for organizing different criteria and evaluating the importance and preference of each of them over options, simplifies the decision process. This method can be implemented in SuperDecision or Excel software. Figure A.2 shows the difference between network and hierarchical structure.



(a) A hierarchy



(b) A network

Figure A.2. Structure of a network and a hierarchy

A.5. Fuzzy VIKOR

VIKOR is a method for optimizing complex multi-criteria development systems that offers compromising solutions and is able to create stability decision-making performance by replacing the adaptive solution with the primary weight. Adaptive solution theory is a practical solution that is close to the ideal solution, and adaptation means agreement made by scores. VIKOR method provides the maximum productivity of the "majority" group and the minimum individual regret of the "opposite" group and the agreed solution can be easily achieved by decision makers. The concept of practical solution (F^c) and ideal solution (F^*) are shown in Figure A.3.

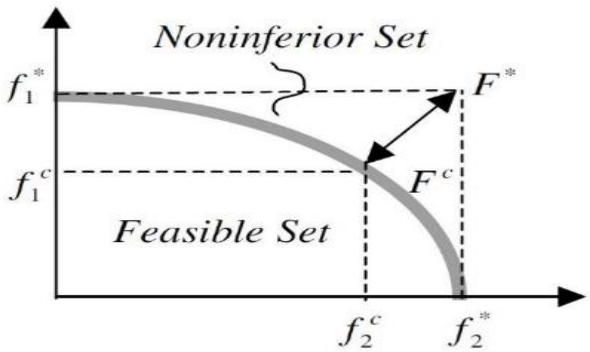


Figure A.3. Different between adaptive solution and Ideal 1

However, the VIKOR method is not able to model uncertainty due to lack of information or in sometimes lack of accurate information. On the other hand, fuzzy method as one of the powerful and useful methods in the field of complex and ambiguous environments modeling and has proven its capabilities in this field. Therefore, the VIKOR method is combined with the fuzzy method and is known as the fuzzy VIKOR method. The process and phase methodology of VIKOR includes the following steps:

Step 1: Form a decision-making team, determine possible alternatives and identify evaluation criteria

Step 2: Determine the appropriate linguistic variables for scoring alternatives according to the criteria. Linguistic variables for rating of the alternatives are as Table A.4.

Table A.4. Linguistic variables of FVIKOR

Linguistic terms	Corresponding fuzzy numbers
Very poor (VP)	(0.0, 0.0, 1.0)
Poor (P)	(0.0, 1.0, 3.0)
Medium Poor (MP)	(1.0, 3.0, 5.0)
Fair (F)	(3.0, 5.0, 7.0)
Medium good (MG)	(5.0, 7.0, 9.0)
Good (G)	(7.0, 9.0, 10.0)
Very good (VG)	(9.0, 10.0, 10.0)

Step 3: Combine the priorities and opinions of the n decision makers and calculate the average as Equation (A.11).

$$\tilde{x}_{ij} = \frac{1}{n}\left[\sum_{e=1}^{n} \tilde{x}_{ij}^{e}\right] \tag{A.11}$$

Step 4: Calculate the average fuzzy weight and build a fuzzy (normal) decision matrix where $\tilde{x}_{ij}$ is the score of alternatives A_i based on the criteria of C_j as Equation (A.12).

$$\tilde{D} = \begin{bmatrix} \tilde{x}_{11} & \tilde{x}_{12} & \cdots & \tilde{x}_{1n} \\ \tilde{x}_{21} & \tilde{x}_{22} & \cdots & \tilde{x}_{2n} \\ \vdots & \vdots & \cdots & \vdots \\ \tilde{x}_{m1} & \tilde{x}_{m2} & \cdots & \tilde{x}_{mn} \end{bmatrix} \tag{A.12}$$

Step 5: calculate de-fuzzy of values using the Equation (A.13).

$$x_{ij} = \frac{\left[(Ux_{ij} - Lx_{ij}) + (Mx_{ij} - Lx_{ij})\right]}{3} + Lx_{ij} \tag{A.13}$$

Step 6: determine the Best Value (BV) and the Worst Value (WV) as Equation (A.14).

$$f_i^{-} = \min_i x_{ij} \;, \qquad f_i^{*} = \max_i x_{ij} \tag{A.14}$$

Step 7: calculate the value of s_i and R_i as Equations (A.15 and A.16).

$$S_i = \sum_{j=1}^{n} w_j (f_j^{*} - x_{ij}) / (f_j^{*} - f_j^{-}) \tag{A.15}$$

$$R_i = \max_j \left[w_j (f_j^{*} - x_{ij}) / (f_j^{*} - f_j^{-}) \right] \tag{A.16}$$

Step 8: determine s^{-}, s^{*}, R^{-}, R^{*}, and Q_i as Equations (A.17 to A.19).

$$S^{*} = \min_i S_i \;, \qquad S^{-} = \max_i S_i \tag{A.17}$$

$$R^{-} = \max_i R_i \;, \qquad R^{*} = \min_i R_i \tag{A.18}$$

$$Q_j = v (S_i - S^{*}) / (S^{-} - S^{*}) + (1 - v)(R_i - R^{*}) / (R^{-} - R^{*}) \tag{A.19}$$

Where v means the weight of the group's maximum productivity strategy. When $v > 0.5$, the decision tends to move toward the majority. However, when $v = 0.5$, the decision tends to lead to the resignation of the opposing person.

Step 9: Prioritizing the alternatives based on Q_i.

Step 10: Determine the agreed solution. Assume that the following two conditions are acceptable. Then, considering Q_i, determine the agreed solution as the only desirable solution.

Condition 1. Acceptable advantage based on Equations (A.20 and A.21).

$$Q(a'') - Q(a') \geq DQ \tag{A.20}$$

$$DQ = \frac{1}{m-1} (DQ = 0.25 \text{ if } m \leq 4) \tag{A.21}$$

Condition 2. Acceptable stability in decision making: a' should be ranked with use of S and R.

If one of the conditions above is not met, then a set of agreed solutions is suggested. That include:

If condition 1 is not met and () then a' has not the agreed advantage and the agreed solutions of

a', a'',…, $a^{(m)}$ are equal. If condition 2 is not met, stability in decision making is imperfect. a' has the agreed advantage and a' is equal to a''.

Step 11: Select the best solution. Q(a') is the best solution with minimum Q_i.

B. FDEMATEL results

Table B.1: the expert opinion average for FDEMATEL

	Efficiency			Feasibility			Environmental			Economic			Cultural-social acceptance			Legal		
	l	*m*	*u*	*l*	*m*	*u*	*l*	*m*	*u*	*l*	*m*	*u*	*l*	*m*	*u*	*l*	*m*	*u*
Efficiency	0.00	0.00	0.00	1.00	1.00	1.00	1.33	1.67	2.00	8.00	9.00	9.00	5.33	6.33	7.33	1.00	1.00	1.00
Feasibility	7.33	8.33	8.33	0.00	0.00	0.00	1.00	1.00	1.00	4.67	5.67	6.67	5.33	6.33	7.33	4.67	5.67	6.67
Environmental	3.33	4.33	5.33	6.67	7.67	8.33	0.00	0.00	0.00	4.67	5.67	6.67	1.00	1.00	1.00	1.00	1.00	1.00
Economic	7.33	8.33	8.33	6.67	7.67	8.33	2.67	3.67	4.67	0.00	0.00	0.00	5.33	6.33	7.33	5.33	6.33	7.33
Cultural-social acceptance	1.00	1.00	1.00	2.67	3.67	4.67	4.00	5.00	6.00	6.00	7.00	8.00	0.00	0.00	0.00	5.33	6.33	7.33
Legal	5.33	6.33	7.33	8.00	9.00	9.00	5.33	6.33	7.33	7.33	8.33	8.33	1.00	1.00	1.00	0.00	0.00	0.00

Table B.2: The normalized fuzzy matrix

	Efficiency			Feasibility			Environmental			Economic			Cultural-social acceptance			Legal		
	l	*m*	*u*	*l*	*m*	*u*	*l*	*m*	*u*	*l*	*m*	*u*	*l*	*m*	*u*	*l*	*m*	*u*
Efficiency	0.00	0.00	0.00	0.03	0.03	0.03	0.04	0.05	0.06	0.22	0.25	0.25	0.15	0.18	0.20	0.03	0.03	0.03
Feasibility	0.20	0.23	0.23	0.00	0.00	0.00	0.03	0.03	0.03	0.13	0.16	0.19	0.15	0.18	0.20	0.13	0.16	0.19
Environmental	0.09	0.12	0.15	0.19	0.21	0.23	0.00	0.00	0.00	0.13	0.16	0.19	0.03	0.03	0.03	0.03	0.03	0.03
Economic	0.20	0.23	0.23	0.19	0.21	0.23	0.07	0.10	0.13	0.00	0.00	0.00	0.15	0.18	0.20	0.15	0.18	0.20
Cultural-social acceptance	0.03	0.03	0.03	0.07	0.10	0.13	0.11	0.14	0.17	0.17	0.19	0.22	0.00	0.00	0.00	0.15	0.18	0.20
Legal	0.15	0.18	0.20	0.22	0.25	0.25	0.15	0.18	0.20	0.20	0.23	0.23	0.03	0.03	0.03	0.00	0.00	0.00

Table B.3: Fuzzy total relation matrix

	Efficiency			Feasibility			Environmental			Economic			Cultural-social acceptance			Legal		
	l	*m*	*u*	*l*	*m*	*u*	*l*	*m*	*u*	*l*	*m*	*u*	*l*	*m*	*u*	*l*	*m*	*u*
Efficiency	0.15	0.27	0.42	0.18	0.30	0.46	0.13	0.22	0.36	0.37	0.53	0.72	0.26	0.38	0.55	0.15	0.25	0.39
Feasibility	0.38	0.56	0.78	0.18	0.34	0.58	0.15	0.26	0.45	0.36	0.58	0.87	0.30	0.46	0.69	0.27	0.42	0.64
Environmental	0.25	0.40	0.59	0.30	0.44	0.64	0.08	0.16	0.30	0.29	0.46	0.70	0.16	0.27	0.44	0.14	0.24	0.40
Economic	0.41	0.62	0.88	0.38	0.58	0.86	0.20	0.35	0.59	0.28	0.51	0.83	0.32	0.50	0.76	0.30	0.47	0.73

Cultural-social acceptance	0.21	0.37	0.60	0.25	0.43	0.69	0.21	0.33	0.54	0.35	0.55	0.85	0.13	0.26	0.47	0.26	0.41	0.63
Legal	0.38	0.59	0.83	0.42	0.61	0.84	0.26	0.40	0.60	0.45	0.68	0.95	0.22	0.38	0.59	0.17	0.31	0.51

Table B.4: The crisp total relation matrix

	Efficiency	Feasibility	Environmental	Economic	Cultural-social acceptance	Legal	D
Efficiency	0.2768	0.303	0.226	0.535204	0.38962689	0.2564	1.9867
Feasibility	0.5679	0.357	0.271	0.590606	0.468015144	0.4291	2.6834
Environmental	0.4052	0.451	0.167	0.470222	0.277848239	0.2511	2.0226
Economic	0.6307	0.595	0.365	0.52442	0.514490902	0.4869	3.1172
Cultural-social acceptance	0.3844	0.441	0.344	0.567101	0.272373758	0.4192	2.4288
Legal	0.5938	0.618	0.407	0.689072	0.388664543	0.3206	3.0170
R	2.8587	2.7651	1.7811	3.3766	2.3110	2.1632	1.9867

C. Best-to-Others and Others-to-Worst comparison vectors

Table C.1: Best-to-Others comparison vector

Criteria		**Efficiency**			**Feasibility**			**Environmental**			**Economic**			**Cultural-social acceptance**			**Legal**		
Average of experts' opinion	**Economic (Best criterion)**	*l*	*m*	*u*	*l*	*m*	*u*	*l*	*m*	*u*	*l*	*m*	*u*	*l*	*m*	*u*	*l*	*m*	*u*
		0.67	1.00	1.50	0.94	1.33	1.83	2.50	3.00	3.50	1.00	1.00	1.00	1.50	2.00	2.50	1.22	1.67	2.17

Table C.2: Others-to-Worst comparison vector

Criteria	**Cultural-social acceptance (Worst criterion)**	
	Average of experts' opinion	
Efficiency	*l*	2.50
	m	3.00
	u	3.50
Feasibility	*l*	2.17
	m	2.67
	u	3.17
Environmental	*l*	1.00
	m	1.00
	u	1.00
Economic	*l*	2.50
	m	3.00
	u	3.50
Cultural-social acceptance	*l*	1.22
	m	1.67
	u	2.17

Legal	*l*	1.83
	m	2.33
	u	2.83

D. The decision tree of this research in Super Decision software

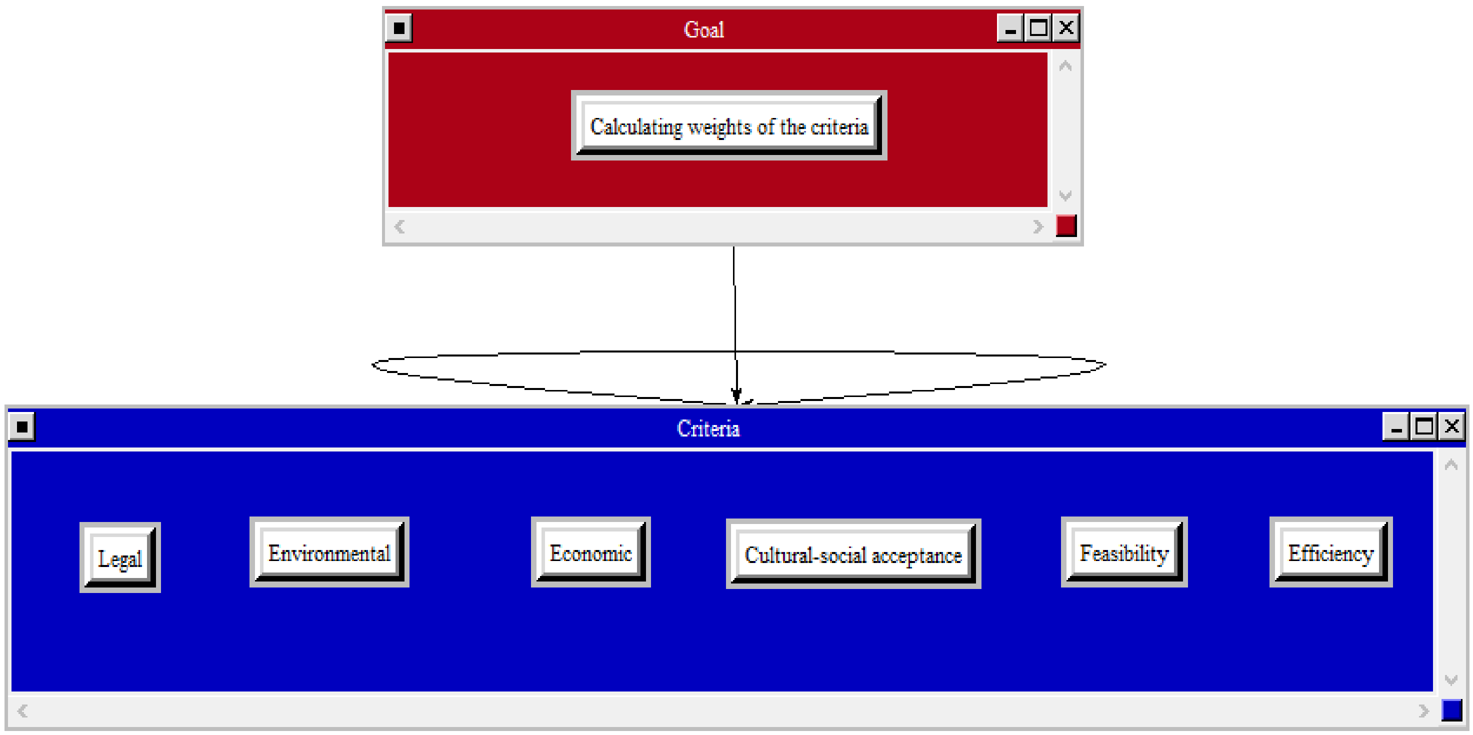


Figure D.1: Implementation of decision tree in SuperDecision software

E. FVIKOR results

Table E.1: The expert opinion average for FVIKOR

Criteria / Strategy	Efficiency			Feasibility			Environmental			Economic			Cultural-social acceptance			Legal		
	l	*m*	*u*	*l*	*m*	*u*	*l*	*m*	*u*	*l*	*m*	*u*	*l*	*m*	*u*	*l*	*m*	*u*
Strategy 1	7.54	9.61	10	5.96	7.94	9.5	0	0.91	2.61	5.6	7.37	9.1	1.5	3.5	5.46	8.3	9.56	10
Strategy 2	3.38	5.2	7.03	3.38	5.49	7.89	0.21	1.2	3.04	1.7	4.23	6.16	7.25	9.05	9.9	3.5	5.53	7.54
Strategy 3	2.56	3.86	6.04	1.2	3.3	5.45	0.34	1.42	3.56	1.85	4.45	6.62	6	8	9.5	3.33	5.42	7.67
Strategy 4	4.95	6.91	8.82	3.2	5.33	7.41	7.1	9.3	9.68	3.32	5.49	7.89	5.5	7.54	9.24	5.5	7.54	9.23
Strategy 5	5.86	7.14	8.1	5.12	7.29	9.06	3.5	5.8	7.48	8	9.52	10	5.75	7.75	9.43	6	8.04	9.56
Strategy 6	5.44	6.97	9.85	6.96	7.81	9.92	6.16	7.78	9.13	7.5	9.25	10	7.5	9.25	10	8	9.5	10
Strategy 7	4.81	5.2	7.12	6.87	7.67	9.83	5.46	7.68	9.21	5.5	7.45	9.25	7	9	10	7.25	8.75	9.5

Table E.2: The normalized fuzzy matrix of FVIKOR

Criteria / Strategy	Efficiency			Feasibility			Environmental			Economic			cultural-social acceptance			Legal		
	l	*m*	*u*	*l*	*m*	*u*	*l*	*m*	*u*	*l*	*m*	*u*	*l*	*m*	*u*	*l*	*m*	*u*
Strategy 1	0.218	0.214	0.175	0.182	0.177	0.160	0	0.026	0.058	0.167	0.154	0.154	0.037	0.064	0.085	0.198	0.175	0.157
Strategy 2	0.097	0.115	0.123	0.103	0.122	0.133	0.009	0.035	0.067	0.050	0.088	0.104	0.179	0.167	0.155	0.835	0.101	0.118
Strategy 3	0.074	0.085	0.106	0.036	0.073	0.092	0.014	0.041	0.079	0.055	0.093	0.112	0.148	0.147	0.149	0.795	0.099	0.120
Strategy 4	0.143	0.153	0.154	0.097	0.118	0.125	0.311	0.272	0.216	0.099	0.114	0.133	0.135	0.139	0.145	0.131	0.138	0.145
Strategy 5	0.169	0.159	10.142	0.156	0.162	0.153	0.153	0.170	0.167	0.239	0.199	0.169	0.141	0.143	0.148	0.143	0.147	0.150
Strategy 6	0.157	0.155	0.172	0.212	0.174	0.167	0.270	0.228	0.204	0.224	0.193	0.169	0.185	0.171	0.157	0.191	0.174	0.157
Strategy 7	0.139	0.115	0.125	0.210	0.171	0.166	0.239	0.225	0.205	0.164	0.155	0.156	0.172	0.166	0.157	0.173	0.161	0.149

Table E.3: De-fuzzy values for FVIKOR

Criteria / Strategy	Efficiency	Feasibility	Environmental	Economic	Cultural-social acceptance	Legal
Strategy 1	0.202	0.173	0.028	0.158	0.062	0.177
Strategy 2	0.112	0.119	0.037	0.081	0.167	0.101
Strategy 3	0.088	0.067	0.045	0.086	0.148	0.100
Strategy 4	0.150	0.114	0.267	0.115	0.140	0.138
Strategy 5	0.156	0.157	0.163	0.202	0.144	0.147
Strategy 6	0.161	0.185	0.234	0.195	0.171	0.174
Strategy 7	0.126	0.182	0.223	0.159	0.165	0.161

Table E.4: the maximum and minimum value of each criterion

	Efficiency	Feasibility	Environmental	Economic	Cultural-social acceptance	Legal
f^+	0.202	0.185	0.267	0.202	0.171	0.177
f^-	0.088	0.067	0.028	0.081	0.062	0.100

Table E.5: FVIKOR results

	Utility measure		Regret Measure			
Strategy 1	S_1	0.313	R_1	0.111	Q_1	0.176
Strategy 2	S_2	0.741	R_2	0.210	Q_2	0.748
Strategy 3	S_3	0.894	R_3	0.262	Q_3	1
Strategy 4	S_4	0.478	R_4	0.150	Q_4	0.398
Strategy 5	S_5	0.266	R_5	0.105	Q_5	0.126
Strategy 6	S_6	0.123	R_6	0.093	Q_6	0
Strategy 7	S_7	0.301	R_7	0.174	Q_7	0.355
	S^*	0.123	R^*	0.093		

	S^-	0.894	R^-	0.262	