Neutrosophic Sets and Systems, Vol. 67, 2024
University of New Mexico

Evaluation Strategies of Leadership Management in Healthcare Systems: An Integrated Type-II Neutrosophic Optimization Approach

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Abstract: This study presented a decision-making methodology to evaluate leadership management strategies in healthcare systems. This study used the multi-criteria decision-making (MCDM) methodology to deal with conflicting criteria in the decision-making process. The MCDM methodology is integrated with neutrosophic sets to deal with uncertainty and vague information in decision-making. The neutrosophic set has three memberships: truth, indeterminacy, and falsity. The type-2 neutrosophic set is a subset of the neutrosophic set with nine membership degrees. The neutrosophic set integrated with the COPRAS method to rank the alternatives. fourteen criteria and eleven alternatives are used to evaluate leadership management in healthcare systems. The sensitivity analysis was conducted to show the stability of the rank. The sensitivity analysis was performed with 15 cases to change the criteria weights and rank the alternatives under different weights. The results show that the rank of other options is stable in various instances.

Keywords: Neutrosophic Sets; Leadership Management; Management Strategies; Uncertainty; MCDM.

1. Introduction

Leadership theories were not formed in healthcare environments; they were developed in the corporate world and then adapted to the healthcare unit. As a result, the ideas are dynamic and subject to change throughout time. Healthcare organizations are made up of intricate relationships between many different types of experts in various jobs[1], [2].

Healthcare organizations' distinctive structures typically adhere to long-standing customs resistant to change. Effective collaboration is a crucial deficiency in many areas of health care. Thus, it takes competent leadership to implement the changes required for organizations to increase their quality. Some individuals conflate the phrases leadership and management. Peter Drucker claims that although management does things correctly, leadership does the right things[3], [4].

Management places a great emphasis on maintaining the status quo, whereas leadership promotes creativity and change for the organization's future. The healthcare sector is becoming more and more competitive these days due to environmental changes, and leadership is now the cornerstone for encouraging and driving change in the future[5], [6]. There are inner ties within an organization that anybody may access to become a leader. It's merely inspiring others to work tirelessly towards achieving common objectives.

This can strongly emphasize working together inside organizations so that followers and leaders can motivate one another more and value the interdependencies among various stakeholders. A person's behavior while organizing efforts towards a shared goal and adjusting to change has been described as leadership. Many people must develop leadership as a complex collection of behaviors within particular organizational and inter-organizational cultures[7], [8].

Collaboration between diverse groups and healthcare administration is necessary to achieve the long-term objective of lowering sickness and enhancing community health. Managers working in healthcare environments can use cooperative communication techniques that transcend conventional organizational boundaries[9], [10].

Healthcare leadership roles are frequently seen as a highly specialized subset of more general management topics and discussions on management education. Spiritually mature healthcare executives may significantly increase their company's beneficial outcomes by pushing the boundaries, fostering a common vision, and inspiring people to operate traditionally [11], [12].

The multi-criteria decision-making (MCDM) methodology deals with conflict criteria. The COPRAS method is used to rank the alternatives. Zavadskas, Kaklauskas, and Sarka introduced the COmplex PRoportional ASsessment (COPRAS) approach. Using this approach, the maximizing and minimizing of index values are evaluated, and the impact of maximizing and minimizing attribute indexes on evaluating outcomes is considered independently. Several domains use the COPRAS technique, including material selection, investment project selection, and risk assessment. Consequently, the following characteristics are considered for this method: It's a way of compensation; Features stand alone; The process transforms the qualitative attributes into quantitative ones[13], [14].

Zadeh introduced the fuzzy set theory as a generalization of classical sets. Following Zadeh's work, scholars began paying more attention to fuzzy set theory, and the number of academic works on the subject has quickly expanded across several disciplines, including the social sciences, engineering, and economics[15], [16]. A membership function describes a fuzzy set. The fuzzy sets whose degrees of membership are described in language words like low, medium, high, very low, not low, and not high are closely related to the idea of linguistic truth. However, a mapping from discourse universe U to subsets of the interval [0,1] may be applied to a fuzzy set A defined by a membership function containing linguistic variables[17], [18].

Atanassov [19] presented the idea of intuitionistic fuzzy sets as a generalization of fuzzy sets. Membership and non-membership functions are the two functions that define an intuitionistic fuzzy set. A valuable technique for modeling hesitancy-related scenarios is an intuitionistic fuzzy set.

Thus, Smarandache proposed the neutrosophic set theory to address inconsistency-related issues. A neutrosophic set is a generalization of the intuitionistic, classical, fuzzy, paraconsistent, dialetheism, paradoxes, and tautological sets based on neutrosophy[20], [21]. A subfield of philosophy known as neutrosophic examines genesis, characteristics, and use of neutralities. An argument, theory, event, idea, or thing identified as "A" in neurology is compared to its opposite, "Anti-A," and to that which is not A, or "Non-A," as well as to that which is neither "A" nor "Anti-A," or "Neut-A."[22], [23].

The neutrosophic set is defined by three functions, from the universal set to the natural or non-real standard subset. These are known as the independent truth-membership function, indeterminacy membership function, and falsity membership function. While the neutrosophic set theory helps model certain issues, it presents challenges for modeling specific engineering issues[24], [25].

1.1 Strategies of Leadership Management

A manager's use of direction, incentive, and influence to assist in the accomplishment of an organizational objective is an example of strategic leadership. A sales manager assembling their team and delivering a motivating speech before a significant sales event is one example of this. The leader guides, inspires, and motivates the sales team to help them reach their target[26], [27].

Leadership is an individual's ability to inspire, persuade, and direct others within an organization toward accomplishing a goal. In business leadership, managers work together to motivate, influence, and guide their subordinates toward a performance goal, such as hitting a sales target and using best practices in directing, motivating, and controlling. The manager's overall leadership qualities become apparent when their team consistently meets the goals that have been established. Strategic leadership is one of the numerous subcategories of leadership styles that fall under the giant leadership umbrella[28], [29].

The capacity of a manager to effectively communicate an organization's strategic vision to its staff members in a way that inspires them to pursue the same goals and underlying assumptions of success is known as strategic leadership. When people start making decisions independently with the organization's goals and vision in mind, it is a sign that strategic management has been successfully implemented in the company. One of the main elements of success in any organization is the manager's ability to apply strategy in the day-to-day management of personnel to assist boost productivity and employee happiness.

In the healthcare industry, strategic management may be implemented at any one of the three organizational levels. Stakeholders, executives, and the board of directors participate in corporate planning. Corporate strategies concentrate on articulating the mission and vision of the organization and achieving its overarching objectives. The management of a healthcare organization is involved in business planning. It describes how managers and staff members may assist in achieving plans and objectives at the corporate level. The interactions between physicians and patients are the main emphasis of functional planning. Production, marketing, research, and service delivery to patients and clients are all included in functional-level strategic planning[30], [31].

1.2 Contributions of this study

- The proposed methodology presents an uncertainty methodology for overcoming uncertainty in evaluation strategies of leadership management healthcare systems by using type-2 neutrosophic numbers.
- The type-2 neutrosophic COPRAS method is used to rank leadership management strategies in healthcare systems.
- The MCDM methodology is used to deal with various conflict criteria in the decision-making the decision-making process.
- Fifteen criteria and eleven alternatives are used to evaluate leadership management strategies in healthcare systems.
- The sensitivity analysis is conducted to show the stability of the rank of alternatives.

1.3 Organization of this study

The rest of this study is organized as follows: Section 2 presents the definitions of type-2 neutrosophic sets. Section 3 presents the proposed methodology and steps of the COPRAS method. Section 4 presents the results of the COPRAS method. Section 5 presents the sensitivity analysis. Section 6 presents the conclusions of this study.

2. Type-II Neutrosophic Sets

This section offers some definitions of type-2 neutrosophic numbers (T2NNs)[32], [33].

Definition 1.

Offer X is a limited universe of discourse and y[0,1] is a group of neutrosophic triangular. A T2NN presented by U defined in X as:

$$U = \{(x, T_U(x), I_U(x), F_U(x) |\ x \in X)\} \quad (1)$$

$$\begin{pmatrix} T_U(x) \rightarrow Y[0,1] \\ I_U(x) \rightarrow Y[0,1] \\ F_U(x) \rightarrow Y[0,1] \end{pmatrix} \quad (2)$$

$$\begin{pmatrix} T_U(x) = T_{T_U}(x), T_{I_U}(x), T_{F_U}(x) \\ I_U(x) = I_{T_U}(x), I_{I_U}(x), I_{F_U}(x) \\ F_U(x) = F_{T_U}(x), F_{I_U}(x), F_{F_U}(x) \end{pmatrix} \quad (3)$$

$$0 \leq T_U(x)^3 + I_U(x)^3 + F_U(x)^3 \leq 3 \quad (4)$$

$$U = \left(\left(T_{T_U}(x), T_{I_U}(x), T_{F_U}(x)\right), \left(I_{T_U}(x), I_{I_U}(x), I_{F_U}(x)\right), \left(F_{T_U}(x), F_{I_U}(x), F_{F_U}(x)\right)\right) \quad (5)$$

Definition 2.

The summations of two T2NNs can be computed as:

$U_1 = \left(\left(T_{T_{U_1}}(x), T_{I_{U_1}}(x), T_{F_{U_1}}(x)\right), \left(I_{T_{U_1}}(x), I_{I_{U_1}}(x), I_{F_{U_1}}(x)\right), \left(F_{T_{U_1}}(x), F_{I_{U_1}}(x), F_{F_{U_1}}(x)\right)\right)$ and

$$U_2 = \left(\left(T_{T_{U_2}}(x), T_{I_{U_2}}(x), T_{F_{U_2}}(x)\right), \left(I_{T_{U_2}}(x), I_{I_{U_2}}(x), I_{F_{U_2}}(x)\right), \left(F_{T_{U_2}}(x), F_{I_{U_2}}(x), F_{F_{U_2}}(x)\right)\right)$$

$$U_1 \oplus U_2 = \begin{pmatrix} \begin{pmatrix} T_{T_{U_1}}(x) + T_{T_{U_2}}(x) - T_{T_{U_1}}(x) \times T_{T_{U_2}}(x), \\ T_{I_{U_1}}(x) + T_{I_{U_2}}(x) - T_{I_{U_1}}(x) \times T_{I_{U_2}}(x), \\ T_{F_{U_1}}(x) + T_{F_{U_2}}(x) - T_{F_{U_1}}(x) \times T_{F_{U_2}}(x) \end{pmatrix}, \\ \left(I_{T_{U_1}}(x) \times I_{T_{U_2}}(x), I_{I_{U_1}}(x) \times I_{I_{U_2}}(x), I_{F_{U_1}}(x) \times I_{F_{U_2}}(x)\right), \\ \left(F_{T_{U_1}}(x) \times F_{T_{U_2}}(x), F_{I_{U_1}}(x) \times F_{I_{U_2}}(x), F_{F_{U_1}}(x) \times F_{F_{U_2}}(x)\right) \end{pmatrix} \quad (6)$$

Multiplication

$$U_1 \otimes U_2 = \begin{pmatrix} \left(T_{T_{U_1}}(x) \times T_{T_{U_2}}(x), T_{I_{U_1}}(x) \times T_{I_{U_2}}(x), T_{F_{U_1}}(x) \times T_{F_{U_2}}(x)\right), \\ \begin{pmatrix} I_{T_{U_1}}(x) + I_{T_{U_2}}(x) - I_{T_{U_1}}(x) \times I_{T_{U_2}}(x), \\ I_{I_{U_1}}(x) + I_{I_{U_2}}(x) - I_{I_{U_1}}(x) \times I_{I_{U_2}}(x), \\ I_{F_{U_1}}(x) + I_{F_{U_2}}(x) - I_{F_{U_1}}(x) \times I_{F_{U_2}}(x) \end{pmatrix}, \\ \begin{pmatrix} F_{T_{U_1}}(x) + F_{T_{U_2}}(x) - F_{T_{U_1}}(x) \times F_{T_{U_2}}(x), \\ F_{I_{U_1}}(x) + F_{I_{U_2}}(x) - F_{I_{U_1}}(x) \times F_{I_{U_2}}(x), \\ F_{F_{U_1}}(x) + F_{F_{U_2}}(x) - F_{F_{U_1}}(x) \times F_{F_{U_2}}(x) \end{pmatrix} \end{pmatrix} \quad (7)$$

Scaler Multiplication

$$\curlyvee U_1 = \begin{pmatrix} \left(1 - \left(1 - T_{T_{U_1}}(x)\right)^{\curlyvee}, 1 - \left(1 - T_{I_{U_1}}(x)\right)^{\curlyvee}, 1 - \left(1 - T_{F_{U_1}}(x)\right)^{\curlyvee}\right), \\ \left(I_{T_{U_1}}(x)^{\curlyvee}, I_{I_{U_1}}(x)^{\curlyvee}, I_{F_{U_1}}(x)^{\curlyvee}\right), \\ \left(F_{T_{U_1}}(x)^{\curlyvee}, F_{I_{U_1}}(x)^{\curlyvee}, F_{F_{U_1}}(x)^{\curlyvee}\right) \end{pmatrix} \quad (8)$$

Power

$$U_1^{\curlyvee} = \begin{pmatrix} \left(\left(T_{T_{U_1}}(x)^{\curlyvee}, T_{I_{U_1}}(x)^{\curlyvee}, T_{F_{U_1}}(x)^{\curlyvee}\right)\right), \\ \left(1 - \left(1 - I_{T_{U_1}}(x)\right)^{\curlyvee}, 1 - \left(1 - I_{I_{U_1}}(x)\right)^{\curlyvee}, 1 - \left(1 - I_{F_{U_1}}(x)\right)^{\curlyvee}\right), \\ \left(1 - \left(1 - F_{T_{U_1}}(x)\right)^{\curlyvee}, 1 - \left(1 - F_{I_{U_1}}(x)\right)^{\curlyvee}, 1 - \left(1 - F_{F_{U_1}}(x)\right)^{\curlyvee}\right) \end{pmatrix} \quad (9)$$

Definition 3.

The score function can be computed as:

$$S(U) = \frac{1}{12} \begin{pmatrix} 8 + T_{T_U}(x) + 2\left(T_{I_U}(x) + T_{F_U}(x)\right) - \\ \left(I_{T_U}(x) + I_{I_U}(x)\right) + I_{F_U}(x) - \\ \left(F_{T_U}(x) + 2\left(F_{I_U}(x) + F_{F_U}(x)\right)\right) \end{pmatrix} \quad (10)$$

3. Methodology

This methodology presents the COPRAS method to evaluate leadership management in healthcare systems. COPRAS method integrated with type-2 neutrosophic sets[34], [35]. Figure 1 shows the COPRAS method with type-2 neutrosophic sets. The decision matrix is built between criteria and alternatives:

$$Y = \begin{pmatrix} y_{11} & \cdots & y_{1n} \\ \vdots & \ddots & \vdots \\ y_{m1} & \cdots & y_{mn} \end{pmatrix}_{m \times n} ; i = 1,2, \dots, m, \;\; j = 1,2, \dots, n \quad (11)$$

The normalized decision matrix is computed as:

$$y_{ij}^{*} = \frac{y_{ij}}{\sum_{i=1}^{m} y_{ij}}; \quad j = 1,2, \dots, n \quad (12)$$

The weights of criteria are computed to show the importance of criteria. The weighted normalized decision matrix is computed as:

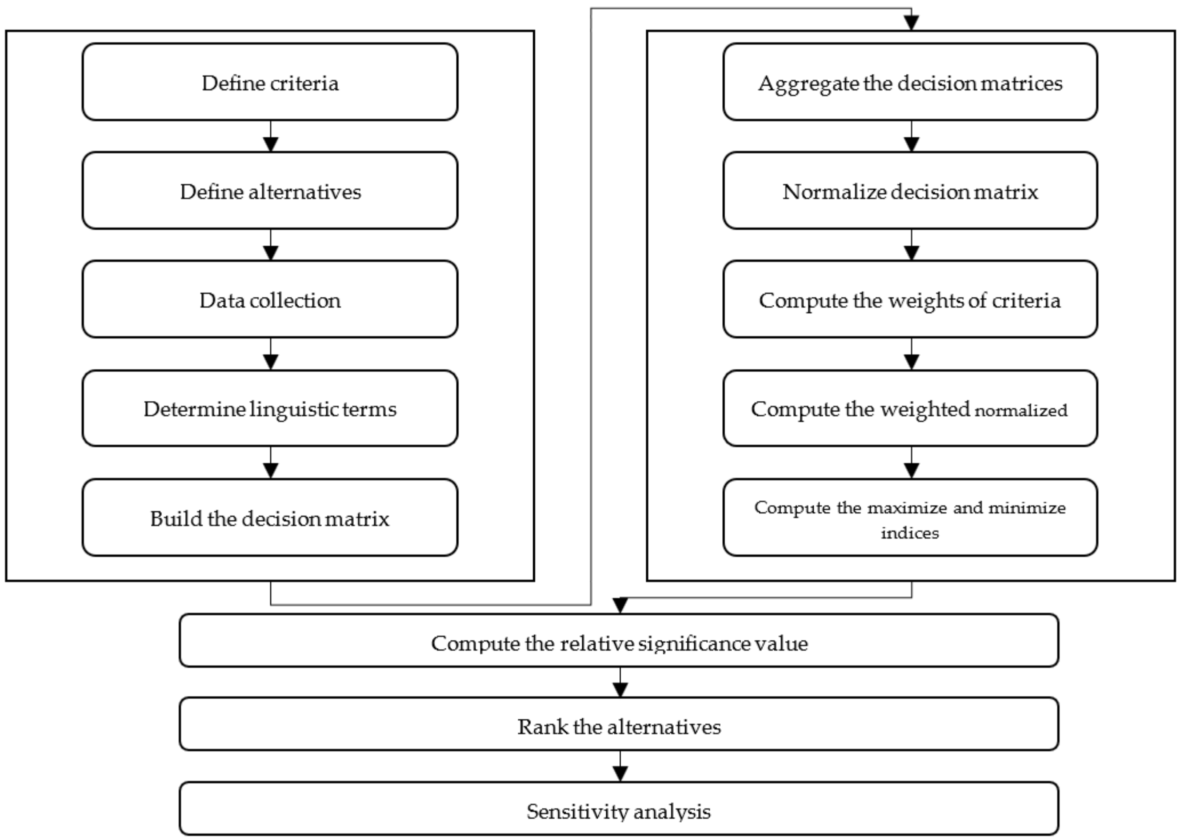

Figure 1. The steps of the neutrosophic COPRAS method

$$r_{ij} = y_{ij} * w_j; \quad i = 1,2, \dots, m, \quad j = 1,2, \dots, n \tag{13}$$

Calculate the maximize and minimize indices as:

$$D_{+i} = \sum_{j=1}^{g} r_{ij}; \quad i = 1,2, \dots, m \tag{14}$$

$$D_{-i} = \sum_{j=g+1}^{n} r_{ij}; \quad i = 1,2, \dots, m \tag{15}$$

Calculate the relative significance value

$$L_i = D_{+i} + \frac{\min_i D_{-i} \sum_{i=1}^{m} D_{-i}}{D_{-i} \sum_{i=1}^{m} \frac{\min_i D_{-i}}{D_{-i}}} \tag{16}$$

$$L_i = D_{+i} + \frac{\sum_{i=1}^{m} D_{-i}}{D_{-i} \sum_{i=1}^{m} \frac{1}{D_{-i}}} \tag{17}$$

4. Results

This section presents the results of the COPRAS method to evaluate the strategies of leadership management in healthcare systems. This study invited three decision-makers to evaluate the criteria and alternatives. The decision-makers used the type-2 neutrosophic numbers as shown in Table 1 [36], [37]. Three decision makers are collected from 14 criteria and 11 alternatives of this study as shown in Figure 2.

Table 1. The linguistic terms of type-2 neutrosophic sets.

Linguistic terms	Type-2 Neutrosophic Numbers
Very Low	<(0.20, 0.20, 0.10), (0.65, 0.80, 0.85), (0.45, 0.80, 0.70)>
Low	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>
Medium Low	<(0.40, 0.30, 0.35), (0.50, 0.45, 0.60), (0.45, 0.40, 0.60)>
Medium	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>
Medium High	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>
High	<(0.70, 0.75, 0.80), (0.15, 0.20, 0.25), (0.10, 0.15, 0.20)>
Very High	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)

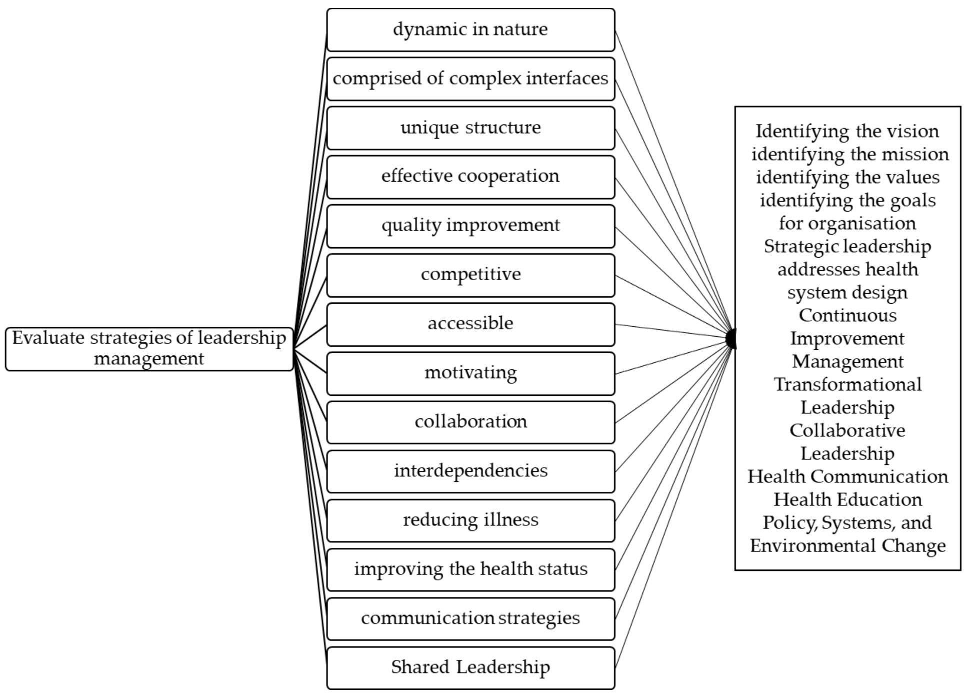

Figure 2. List of criteria and alternatives.

Table 2. Decision matrix by the first decision maker.

	LHC_1	LHC_2	LHC_3	LHC_4	LHC_5	LHC_6	LHC_7
LHA_1	<(0.20, 0.20, 0.10), (0.65, 0.80, 0.85), (0.45, 0.80, 0.70)>	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.70, 0.75, 0.80), (0.15, 0.20, 0.25), (0.10, 0.15, 0.20)>	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)
LHA_2	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.20, 0.20, 0.10), (0.65, 0.80, 0.85), (0.45, 0.80, 0.70)>	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.70, 0.75, 0.80), (0.15, 0.20, 0.25), (0.10, 0.15, 0.20)>	<(0.40, 0.30, 0.35), (0.50, 0.45, 0.60), (0.45, 0.40, 0.60)>
LHA_3	<(0.20, 0.20, 0.10), (0.65, 0.80,	<(0.60, 0.45, 0.50), (0.20, 0.15,	<(0.60, 0.45, 0.50), (0.20, 0.15,	<(0.70, 0.75, 0.80), (0.15, 0.20,	<(0.95, 0.90, 0.95), (0.10, 0.10,	<(0.95, 0.90, 0.95), (0.10, 0.10,	<(0.60, 0.45, 0.50), (0.20, 0.15,

	LHC_8	LHC_9	LHC_{10}	LHC_{11}	LHC_{12}	LHC_{13}	LHC_{14}
LHA_1	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	<(0.70, 0.75, 0.80), (0.15, 0.20, 0.25), (0.10, 0.15, 0.20)>	<(0.20, 0.20, 0.10), (0.65, 0.80, 0.85), (0.45, 0.80, 0.70)>	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.40, 0.30, 0.35), (0.50, 0.45, 0.60), (0.45, 0.40, 0.60)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>
LHA_2	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.70, 0.75, 0.80), (0.15, 0.20, 0.25), (0.10, 0.15, 0.20)>	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>
LHA_3	<(0.70, 0.75, 0.80), (0.15, 0.20,	<(0.60, 0.45, 0.50), (0.20, 0.15,	<(0.35, 0.35, 0.10), (0.50, 0.75,	<(0.40, 0.30, 0.35), (0.50, 0.45,	<(0.50, 0.45, 0.50), (0.40, 0.35,	<(0.50, 0.45, 0.50), (0.40, 0.35,	<(0.50, 0.45, 0.50), (0.40, 0.35,

	0.85), (0.45, 0.80, 0.70)>	0.25), (0.10, 0.25, 0.15)>	0.25), (0.10, 0.25, 0.15)>	0.25), (0.10, 0.15, 0.20)>	0.05), (0.05, 0.05, 0.05)	0.05), (0.05, 0.05, 0.05)	0.25), (0.10, 0.25, 0.15)>	0.25), (0.10, 0.15, 0.20)>	0.25), (0.10, 0.25, 0.15)>	0.80), (0.50, 0.75, 0.65)>	0.60), (0.45, 0.40, 0.60)>	0.50), (0.35, 0.30, 0.45)>	0.50), (0.35, 0.30, 0.45)>	0.50), (0.35, 0.30, 0.45)>
LHA$_4$	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.40, 0.30, 0.35), (0.50, 0.45, 0.60), (0.45, 0.40, 0.60)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.70, 0.75, 0.80), (0.15, 0.20, 0.25), (0.10, 0.15, 0.20)>	<(0.70, 0.75, 0.80), (0.15, 0.20, 0.25), (0.10, 0.15, 0.20)>	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.20, 0.20, 0.10), (0.65, 0.80, 0.85), (0.45, 0.80, 0.70)>	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>
LHA$_5$	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	<(0.40, 0.30, 0.35), (0.50, 0.45, 0.60), (0.45, 0.40, 0.60)>	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.70, 0.75, 0.80), (0.15, 0.20, 0.25), (0.10, 0.15, 0.20)>	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	<(0.20, 0.20, 0.10), (0.65, 0.80, 0.85), (0.45, 0.80, 0.70)>	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.40, 0.30, 0.35), (0.50, 0.45, 0.60), (0.45, 0.40, 0.60)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>
LHA$_6$	<(0.70, 0.75, 0.80), (0.15, 0.20, 0.25), (0.10, 0.15, 0.20)>	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.20, 0.20, 0.10), (0.65, 0.80, 0.85), (0.45, 0.80, 0.70)>	<(0.40, 0.30, 0.35), (0.50, 0.45, 0.60), (0.45, 0.40, 0.60)>	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.20, 0.20, 0.10), (0.65, 0.80, 0.85), (0.45, 0.80, 0.70)>	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	<(0.70, 0.75, 0.80), (0.15, 0.20, 0.25), (0.10, 0.15, 0.20)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.70, 0.75, 0.80), (0.15, 0.20, 0.25), (0.10, 0.15, 0.20)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.70, 0.75, 0.80), (0.15, 0.20, 0.25), (0.10, 0.15, 0.20)>
LHA$_7$	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.20, 0.20, 0.10), (0.65, 0.80, 0.85), (0.45, 0.80, 0.70)>	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	<(0.70, 0.75, 0.80), (0.15, 0.20, 0.25), (0.10, 0.15, 0.20)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.40, 0.30, 0.35), (0.50, 0.45, 0.60), (0.45, 0.40, 0.60)>	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.20, 0.20, 0.10), (0.65, 0.80, 0.85), (0.45, 0.80, 0.70)>	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	<(0.70, 0.75, 0.80), (0.15, 0.20, 0.25), (0.10, 0.15, 0.20)>	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)
LHA$_8$	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.70, 0.75, 0.80), (0.15, 0.20, 0.25), (0.10, 0.15, 0.20)>	<(0.70, 0.75, 0.80), (0.15, 0.20, 0.25), (0.10, 0.15, 0.20)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	<(0.70, 0.75, 0.80), (0.15, 0.20, 0.25), (0.10, 0.15, 0.20)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.40, 0.30, 0.35), (0.50, 0.45, 0.60), (0.45, 0.40, 0.60)>	<(0.40, 0.30, 0.35), (0.50, 0.45, 0.60), (0.45, 0.40, 0.60)>	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)
LHA$_9$	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	<(0.70, 0.75, 0.80), (0.15, 0.20, 0.25), (0.10, 0.15, 0.20)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.40, 0.30, 0.35), (0.50, 0.45, 0.60), (0.45, 0.40, 0.60)>	<(0.40, 0.30, 0.35), (0.50, 0.45, 0.60), (0.45, 0.40, 0.60)>	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)
LHA$_{10}$	<(0.40, 0.30, 0.35), (0.50, 0.45, 0.60), (0.45, 0.40, 0.60)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.70, 0.75, 0.80), (0.15, 0.20, 0.25), (0.10, 0.15, 0.20)>	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	<(0.20, 0.20, 0.10), (0.65, 0.80, 0.85), (0.45, 0.80, 0.70)>	<(0.20, 0.20, 0.10), (0.65, 0.80, 0.85), (0.45, 0.80, 0.70)>	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.40, 0.30, 0.35), (0.50, 0.45, 0.60), (0.45, 0.40, 0.60)>	<(0.40, 0.30, 0.35), (0.50, 0.45, 0.60), (0.45, 0.40, 0.60)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.40, 0.30, 0.35), (0.50, 0.45, 0.60), (0.45, 0.40, 0.60)>	<(0.20, 0.20, 0.10), (0.65, 0.80, 0.85), (0.45, 0.80, 0.70)>
LHA$_{11}$	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	<(0.70, 0.75, 0.80), (0.15, 0.20, 0.25), (0.10, 0.15, 0.20)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.40, 0.30, 0.35), (0.50, 0.45, 0.60), (0.45, 0.40, 0.60)>	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.20, 0.20, 0.10), (0.65, 0.80, 0.85), (0.45, 0.80, 0.70)>	<(0.70, 0.75, 0.80), (0.15, 0.20, 0.25), (0.10, 0.15, 0.20)>	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	<(0.70, 0.75, 0.80), (0.15, 0.20, 0.25), (0.10, 0.15, 0.20)>	<(0.20, 0.20, 0.10), (0.65, 0.80, 0.85), (0.45, 0.80, 0.70)>

Table 3. Decision matrix by the second decision maker.

	LHC$_1$	LHC$_2$	LHC$_3$	LHC$_4$	LHC$_5$	LHC$_6$	LHC$_7$	LHC$_8$	LHC$_9$	LHC$_{10}$	LHC$_{11}$	LHC$_{12}$	LHC$_{13}$	LHC$_{14}$
LHA$_1$	<(0.20, 0.20, 0.10), (0.65, 0.80, 0.85), (0.45, 0.80, 0.70)>	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.70, 0.75, 0.80), (0.15, 0.20, 0.25), (0.10, 0.15, 0.20)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.20, 0.20, 0.10), (0.65, 0.80, 0.85), (0.45, 0.80, 0.70)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.40, 0.30, 0.35), (0.50, 0.45, 0.60), (0.45, 0.40, 0.60)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>
LHA$_2$	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.20, 0.20, 0.10), (0.65, 0.80, 0.85), (0.45, 0.80, 0.70)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.70, 0.75, 0.80), (0.15, 0.20, 0.25), (0.10, 0.15, 0.20)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.70, 0.75, 0.80), (0.15, 0.20, 0.25), (0.10, 0.15, 0.20)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>
LHA$_3$	<(0.20, 0.20, 0.10), (0.65, 0.80, 0.85), (0.45, 0.80, 0.70)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.70, 0.75, 0.80), (0.15, 0.20, 0.25), (0.10, 0.15, 0.20)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.70, 0.75, 0.80), (0.15, 0.20, 0.25), (0.10, 0.15, 0.20)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>
LHA$_4$	<(0.95, 0.90,	<(0.50, 0.45,	<(0.50, 0.45,	<(0.50, 0.45,	<(0.60, 0.45,	<(0.50, 0.45,	<(0.50, 0.45,	<(0.60, 0.45,	<(0.60, 0.45,	<(0.20, 0.20,	<(0.60, 0.45,	<(0.50, 0.45,	<(0.50, 0.45,	<(0.60, 0.45,

	0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	0.10), (0.65, 0.80, 0.85), (0.45, 0.80, 0.70)>	0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>
LHA_5	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>
LHA_6	<(0.70, 0.75, 0.80), (0.15, 0.20, 0.25), (0.10, 0.15, 0.20)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.70, 0.75, 0.80), (0.15, 0.20, 0.25), (0.10, 0.15, 0.20)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.70, 0.75, 0.80), (0.15, 0.20, 0.25), (0.10, 0.15, 0.20)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.70, 0.75, 0.80), (0.15, 0.20, 0.25), (0.10, 0.15, 0.20)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.70, 0.75, 0.80), (0.15, 0.20, 0.25), (0.10, 0.15, 0.20)>
LHA_7	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.70, 0.75, 0.80), (0.15, 0.20, 0.25), (0.10, 0.15, 0.20)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.70, 0.75, 0.80), (0.15, 0.20, 0.25), (0.10, 0.15, 0.20)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.40, 0.30, 0.35), (0.50, 0.45, 0.60), (0.45, 0.40, 0.60)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.20, 0.20, 0.10), (0.65, 0.80, 0.85), (0.45, 0.80, 0.70)>	<(0.70, 0.75, 0.80), (0.15, 0.20, 0.25), (0.10, 0.15, 0.20)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)
LHA_8	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.70, 0.75, 0.80), (0.15, 0.20, 0.25), (0.10, 0.15, 0.20)>	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.70, 0.75, 0.80), (0.15, 0.20, 0.25), (0.10, 0.15, 0.20)>	<(0.70, 0.75, 0.80), (0.15, 0.20, 0.25), (0.10, 0.15, 0.20)>	<(0.70, 0.75, 0.80), (0.15, 0.20, 0.25), (0.10, 0.15, 0.20)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.40, 0.30, 0.35), (0.50, 0.45, 0.60), (0.45, 0.40, 0.60)>	<(0.40, 0.30, 0.35), (0.50, 0.45, 0.60), (0.45, 0.40, 0.60)>	<(0.70, 0.75, 0.80), (0.15, 0.20, 0.25), (0.10, 0.15, 0.20)>	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)
LHA_9	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	<(0.70, 0.75, 0.80), (0.15, 0.20, 0.25), (0.10, 0.15, 0.20)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.70, 0.75, 0.80), (0.15, 0.20, 0.25), (0.10, 0.15, 0.20)>	<(0.40, 0.30, 0.35), (0.50, 0.45, 0.60), (0.45, 0.40, 0.60)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)
LHA_{10}	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.70, 0.75, 0.80), (0.15, 0.20, 0.25), (0.10, 0.15, 0.20)>	<(0.70, 0.75, 0.80), (0.15, 0.20, 0.25), (0.10, 0.15, 0.20)>	<(0.20, 0.20, 0.10), (0.65, 0.80, 0.85), (0.45, 0.80, 0.70)>	<(0.20, 0.20, 0.10), (0.65, 0.80, 0.85), (0.45, 0.80, 0.70)>	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.40, 0.30, 0.35), (0.50, 0.45, 0.60), (0.45, 0.40, 0.60)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.40, 0.30, 0.35), (0.50, 0.45, 0.60), (0.45, 0.40, 0.60)>	<(0.20, 0.20, 0.10), (0.65, 0.80, 0.85), (0.45, 0.80, 0.70)>
LHA_{11}	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	<(0.70, 0.75, 0.80), (0.15, 0.20, 0.25), (0.10, 0.15, 0.20)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.40, 0.30, 0.35), (0.50, 0.45, 0.60), (0.45, 0.40, 0.60)>	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.70, 0.75, 0.80), (0.15, 0.20, 0.25), (0.10, 0.15, 0.20)>	<(0.70, 0.75, 0.80), (0.15, 0.20, 0.25), (0.10, 0.15, 0.20)>	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	<(0.70, 0.75, 0.80), (0.15, 0.20, 0.25), (0.10, 0.15, 0.20)>	<(0.20, 0.20, 0.10), (0.65, 0.80, 0.85), (0.45, 0.80, 0.70)>

Table 4. Decision matrix by the third decision maker.

	LHC_1	**LHC_2**	**LHC_3**	**LHC_4**	**LHC_5**	**LHC_6**	**LHC_7**	**LHC_8**	**LHC_9**	**LHC_{10}**	**LHC_{11}**	**LHC_{12}**	**LHC_{13}**	**LHC_{14}**
LHA_1	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.70, 0.75, 0.80), (0.15, 0.20, 0.25), (0.10, 0.15, 0.20)>	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.40, 0.30, 0.35), (0.50, 0.45, 0.60), (0.45, 0.40, 0.60)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.40, 0.30, 0.35), (0.50, 0.45, 0.60), (0.45, 0.40, 0.60)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.70, 0.75, 0.80), (0.15, 0.20, 0.25), (0.10, 0.15, 0.20)>	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)
LHA_2	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.20, 0.20, 0.10), (0.65, 0.80, 0.85), (0.45, 0.80, 0.70)>	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	<(0.70, 0.75, 0.80), (0.15, 0.20, 0.25), (0.10, 0.15, 0.20)>	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.20, 0.20, 0.10), (0.65, 0.80, 0.85), (0.45, 0.80, 0.70)>
LHA_3	<(0.20, 0.20, 0.10), (0.65, 0.80, 0.85), (0.45, 0.80, 0.70)>	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	<(0.20, 0.20, 0.10), (0.65, 0.80, 0.85), (0.45, 0.80, 0.70)>	<(0.20, 0.20, 0.10), (0.65, 0.80, 0.85), (0.45, 0.80, 0.70)>	<(0.70, 0.75, 0.80), (0.15, 0.20, 0.25), (0.10, 0.15, 0.20)>	<(0.20, 0.20, 0.10), (0.65, 0.80, 0.85), (0.45, 0.80, 0.70)>	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	<(0.20, 0.20, 0.10), (0.65, 0.80, 0.85), (0.45, 0.80, 0.70)>	<(0.20, 0.20, 0.10), (0.65, 0.80, 0.85), (0.45, 0.80, 0.70)>	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>
LHA_4	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05,	<(0.20, 0.20, 0.10), (0.65, 0.80, 0.85), (0.45,	<(0.40, 0.30, 0.35), (0.50, 0.45, 0.60), (0.45,	<(0.20, 0.20, 0.10), (0.65, 0.80, 0.85), (0.45,	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05,	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50,	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50,	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05,	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50,	<(0.20, 0.20, 0.10), (0.65, 0.80, 0.85), (0.45,	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50,	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50,	<(0.20, 0.20, 0.10), (0.65, 0.80, 0.85), (0.45,	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50,

	0.05, 0.05)	0.80, 0.70)>	0.40, 0.60)>	0.80, 0.70)>	0.05, 0.05)	0.75, 0.65)>	0.75, 0.65)>	0.05, 0.05)	0.75, 0.65)>	0.80, 0.70)>	0.75, 0.65)>	0.75, 0.65)>	0.80, 0.70)>	0.75, 0.65)>
LHA₅	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.20, 0.20, 0.10), (0.65, 0.80, 0.85), (0.45, 0.80, 0.70)>	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.20, 0.20, 0.10), (0.65, 0.80, 0.85), (0.45, 0.80, 0.70)>	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>
LHA₆	<(0.20, 0.20, 0.10), (0.65, 0.80, 0.85), (0.45, 0.80, 0.70)>	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.20, 0.20, 0.10), (0.65, 0.80, 0.85), (0.45, 0.80, 0.70)>	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.20, 0.20, 0.10), (0.65, 0.80, 0.85), (0.45, 0.80, 0.70)>	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)
LHA₇	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.20, 0.20, 0.10), (0.65, 0.80, 0.85), (0.45, 0.80, 0.70)>
LHA₈	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	<(0.40, 0.30, 0.35), (0.50, 0.45, 0.60), (0.45, 0.40, 0.60)>	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>
LHA₉	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	<(0.70, 0.75, 0.80), (0.15, 0.20, 0.25), (0.10, 0.15, 0.20)>	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	<(0.40, 0.30, 0.35), (0.50, 0.45, 0.60), (0.45, 0.40, 0.60)>	<(0.40, 0.30, 0.35), (0.50, 0.45, 0.60), (0.45, 0.40, 0.60)>	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>
LHA₁₀	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	<(0.20, 0.20, 0.10), (0.65, 0.80, 0.85), (0.45, 0.80, 0.70)>	<(0.20, 0.20, 0.10), (0.65, 0.80, 0.85), (0.45, 0.80, 0.70)>	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.40, 0.30, 0.35), (0.50, 0.45, 0.60), (0.45, 0.40, 0.60)>	<(0.40, 0.30, 0.35), (0.50, 0.45, 0.60), (0.45, 0.40, 0.60)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	<(0.40, 0.30, 0.35), (0.50, 0.45, 0.60), (0.45, 0.40, 0.60)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>
LHA₁₁	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	<(0.70, 0.75, 0.80), (0.15, 0.20, 0.25), (0.10, 0.15, 0.20)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.60, 0.45, 0.50), (0.20, 0.15, 0.25), (0.10, 0.25, 0.15)>	<(0.50, 0.45, 0.50), (0.40, 0.35, 0.50), (0.35, 0.30, 0.45)>	<(0.40, 0.30, 0.35), (0.50, 0.45, 0.60), (0.45, 0.40, 0.60)>	<(0.35, 0.35, 0.10), (0.50, 0.75, 0.80), (0.50, 0.75, 0.65)>	<(0.20, 0.20, 0.10), (0.65, 0.80, 0.85), (0.45, 0.80, 0.70)>	<(0.70, 0.75, 0.80), (0.15, 0.20, 0.25), (0.10, 0.15, 0.20)>	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)	<(0.70, 0.75, 0.80), (0.15, 0.20, 0.25), (0.10, 0.15, 0.20)>	<(0.95, 0.90, 0.95), (0.10, 0.10, 0.05), (0.05, 0.05, 0.05)

Table 5. The normalized decision matrix.

	LHC₁	LHC₂	LHC₃	LHC₄	LHC₅	LHC₆	LHC₇	LHC₈	LHC₉	LHC₁₀	LHC₁₁	LHC₁₂	LHC₁₃	LHC₁₄
LHA₁	0.054986	0.080818	0.081556	0.082318	0.081081	0.098563	0.105107	0.122441	0.130029	0.047704	0.08306	0.07247	0.098423	0.11544
LHA₂	0.04844	0.040647	0.069905	0.076412	0.093615	0.121109	0.09323	0.08229	0.118026	0.146156	0.137025	0.124696	0.107256	0.06828
LHA₃	0.037312	0.133825	0.105078	0.112034	0.114375	0.089785	0.078583	0.11449	0.081129	0.094139	0.071563	0.067409	0.111672	0.071765
LHA₄	0.145974	0.079154	0.078699	0.061462	0.110262	0.080607	0.079968	0.122441	0.084908	0.04339	0.074613	0.07085	0.070032	0.084888
LHA₅	0.145974	0.076539	0.10266	0.070506	0.077752	0.080607	0.086105	0.083085	0.066904	0.08069	0.08306	0.113968	0.080336	0.098011
LHA₆	0.096225	0.075588	0.062431	0.059432	0.066588	0.072825	0.105107	0.080302	0.111136	0.09693	0.109808	0.084818	0.087066	0.124462
LHA₇	0.090334	0.08676	0.107496	0.0921	0.089698	0.11233	0.105107	0.075929	0.098466	0.08881	0.079071	0.098988	0.105152	0.103137
LHA₈	0.076369	0.131448	0.048802	0.107973	0.102233	0.093376	0.109462	0.099384	0.113359	0.126618	0.077428	0.059514	0.102839	0.106623
LHA₉	0.097316	0.121227	0.062871	0.113695	0.131022	0.114924	0.111441	0.109919	0.07335	0.09896	0.052088	0.057895	0.046688	0.106623
LHA₁₀	0.109753	0.121227	0.133436	0.117756	0.03349	0.034118	0.043943	0.044126	0.07335	0.09896	0.097137	0.113968	0.069401	0.051671
LHA₁₁	0.097316	0.052769	0.147065	0.106312	0.099882	0.101756	0.081948	0.065593	0.049344	0.077645	0.135148	0.135425	0.121136	0.0691

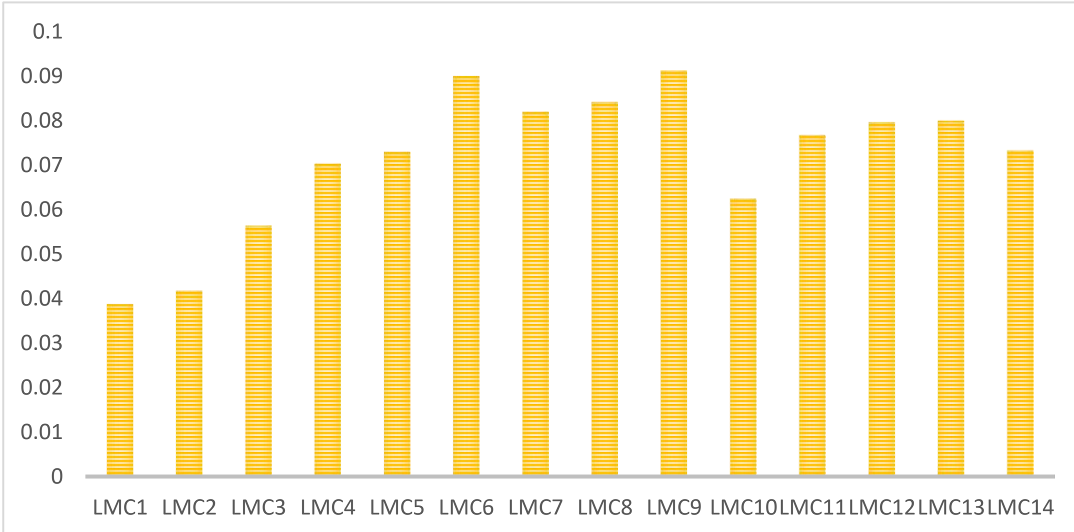

Figure 3. The criteria weights.

Table 6. The weighted normalized decision matrix.

	LHC_1	LHC_2	LHC_3	LHC_4	LHC_5	LHC_6	LHC_7	LHC_8	LHC_9	LHC_{10}	LHC_{11}	LHC_{12}	LHC_{13}	LHC_{14}
LHA_1	0.002132	0.003378	0.004597	0.005791	0.005916	0.008877	0.008615	0.010316	0.01187	0.002981	0.006373	0.005774	0.007874	0.008461
LHA_2	0.001878	0.001699	0.00394	0.005375	0.006831	0.010907	0.007641	0.006933	0.010774	0.009134	0.010514	0.009935	0.00858	0.005004
LHA_3	0.001447	0.005594	0.005922	0.007881	0.008345	0.008086	0.006441	0.009646	0.007406	0.005883	0.005491	0.005371	0.008934	0.00526
LHA_4	0.00566	0.003309	0.004435	0.004324	0.008045	0.00726	0.006554	0.010316	0.007751	0.002712	0.005725	0.005645	0.005603	0.006222
LHA_5	0.00566	0.003199	0.005786	0.00496	0.005673	0.00726	0.007057	0.007	0.006108	0.005043	0.006373	0.00908	0.006427	0.007183
LHA_6	0.003731	0.00316	0.003519	0.004181	0.004859	0.006559	0.008615	0.006766	0.010145	0.006058	0.008425	0.006758	0.006965	0.009122
LHA_7	0.003503	0.003627	0.006058	0.006479	0.006545	0.010117	0.008615	0.006397	0.008989	0.00555	0.006067	0.007887	0.008412	0.007559
LHA_8	0.002961	0.005494	0.00275	0.007596	0.007459	0.00841	0.008972	0.008373	0.010348	0.007913	0.005941	0.004742	0.008227	0.007815
LHA_9	0.003773	0.005067	0.003543	0.007998	0.00956	0.01035	0.009134	0.009261	0.006696	0.006184	0.003997	0.004613	0.003735	0.007815
LHA_{10}	0.004255	0.005067	0.00752	0.008284	0.002444	0.003073	0.003602	0.003718	0.006696	0.006184	0.007453	0.00908	0.005552	0.003787
LHA_{11}	0.003773	0.002206	0.008289	0.007479	0.007288	0.009164	0.006717	0.005526	0.004505	0.004852	0.01037	0.01079	0.009691	0.005064

The decision matrix is built between criteria and alternatives by using Eq. (1) as shown in Tables 2-4. The normalized decision matrix is computed by using Eq. (12) as shown in Table 5. The weights of criteria are computed to show the importance of criteria as shown in Figure 3. The weighted normalized decision matrix is computed by using Eq. (13) as shown in Table 6. Then calculate the maximize and minimize indices by using Eqs. (14 and 15). After that calculate the relative significance value by using Eqs. (16 and 17). Then rank the alternatives as shown in Figure 4.

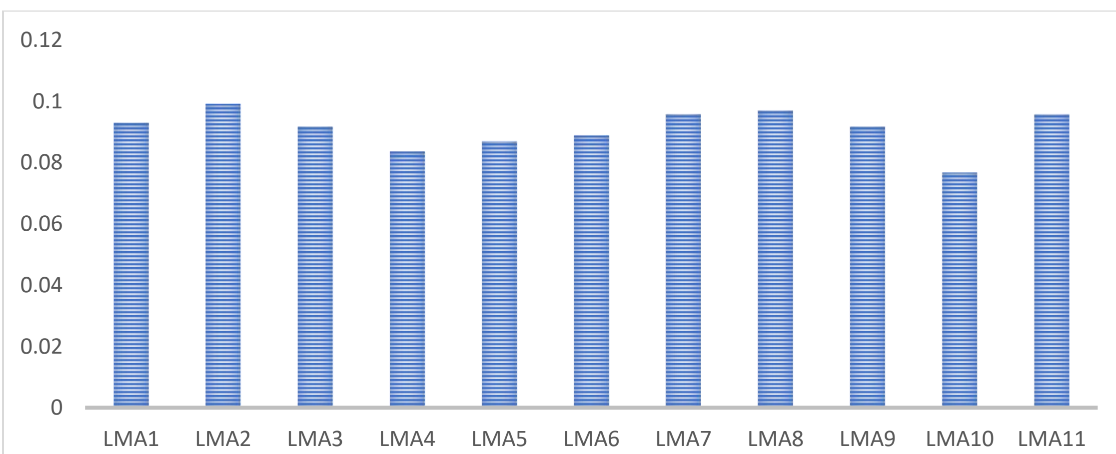

Figure 4. The rank of alternatives.

5. Sensitivity Analysis

This section changes the criteria weights and shows the rank of alternatives to show the stability of the rank. Fifteen cases change the criteria weights with different weights of each criterion. In the first weight, all criteria are given equal weights. In the second weight, the first criterion has a 0.08 weight, and all the other criteria have a weight equal to 0.07142. In the second case, the second criterion has 0.08, and other criteria have weights equal to 0.07142. in the third case, the second criterion has a weight equal to 0.08, and other criteria have weights equal to 0.07142. In the fourth case, the third criterion has weights equal to 0.08, and other criteria have weights equal to 0.07142. Table 7 shows the weights of criteria under sensitivity analysis.

Then, the COPRAS method under a neutrosophic set is applied with different criteria weights. Table 8 shows the rank values of each alternative. Figure 5 shows the rank of other options. The sensitivity analysis results show that the alternatives' rank is stable in different cases.

Table 7. The weights of criteria under sensitivity analysis.

	LHC_1	LHC_2	LHC_3	LHC_4	LHC_5	LHC_6	LHC_7	LHC_8	LHC_9	LHC_{10}	LHC_{11}	LHC_{12}	LHC_{13}	LHC_{14}
LHC1	0.071429	0.08	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769
LHC2	0.071429	0.070769	0.08	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769
LHC3	0.071429	0.070769	0.070769	0.08	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769
LHC4	0.071429	0.070769	0.070769	0.070769	0.08	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769
LHC5	0.071429	0.070769	0.070769	0.070769	0.070769	0.08	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769
LHC6	0.071429	0.070769	0.070769	0.070769	0.070769	0.070769	0.08	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769
LHC7	0.071429	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769	0.08	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769
LHC8	0.071429	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769	0.08	0.070769	0.070769	0.070769	0.070769	0.070769
LHC9	0.071429	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769	0.08	0.070769	0.070769	0.070769	0.070769
LHC10	0.071429	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769	0.08	0.070769	0.070769	0.070769
LHC11	0.071429	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769	0.08	0.070769	0.070769
LHC12	0.071429	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769	0.08	0.070769
LHC13	0.071429	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769	0.08
LHC14	0.071429	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769	0.070769

Table 8. The rank values under sensitivity analysis.

	LHC_1	LHC_2	LHC_3	LHC_4	LHC_5	LHC_6	LHC_7	LHC_8	LHC_9	LHC_{10}	LHC_{11}	LHC_{12}	LHC_{13}	LHC_{14}
LHA_1	0.089571	0.089252	0.08949	0.089497	0.089504	0.089493	0.089654	0.089714	0.089874	0.089945	0.089185	0.089511	0.089413	0.089653
LHA_2	0.094792	0.094364	0.094292	0.094562	0.094622	0.094781	0.095035	0.094778	0.094677	0.095006	0.095266	0.095182	0.095068	0.094907
LHA_3	0.091654	0.091152	0.092043	0.091778	0.091842	0.091864	0.091637	0.091533	0.091865	0.091557	0.091677	0.091469	0.09143	0.091839
LHA_4	0.084803	0.085368	0.084751	0.084747	0.084588	0.085038	0.084765	0.084759	0.085151	0.084804	0.084421	0.084709	0.084675	0.084667
LHA_5	0.089014	0.08954	0.088899	0.08914	0.088843	0.08891	0.088936	0.088987	0.088959	0.08881	0.088937	0.088959	0.089244	0.088934
LHA_6	0.088051	0.088127	0.087936	0.087815	0.087787	0.087853	0.087911	0.088209	0.08798	0.088264	0.088133	0.088252	0.088021	0.088042
LHA_7	0.095241	0.095196	0.095163	0.095355	0.095212	0.09519	0.095399	0.095333	0.095063	0.095271	0.095182	0.095092	0.095276	0.095333
LHA_8	0.096816	0.096627	0.097136	0.096373	0.096919	0.096866	0.096784	0.096933	0.09684	0.096969	0.097091	0.096637	0.096472	0.096872
LHA_9	0.092716	0.092758	0.092979	0.09244	0.092909	0.093069	0.092921	0.092888	0.092874	0.092537	0.092773	0.092341	0.092394	0.092291
LHA_{10}	0.081595	0.081855	0.081961	0.082074	0.081929	0.081151	0.081157	0.081248	0.08125	0.081519	0.081756	0.081739	0.081894	0.081483
LHA_{11}	0.095746	0.09576	0.095349	0.096219	0.095843	0.095784	0.095801	0.095618	0.095467	0.095317	0.095579	0.096109	0.096112	0.09598

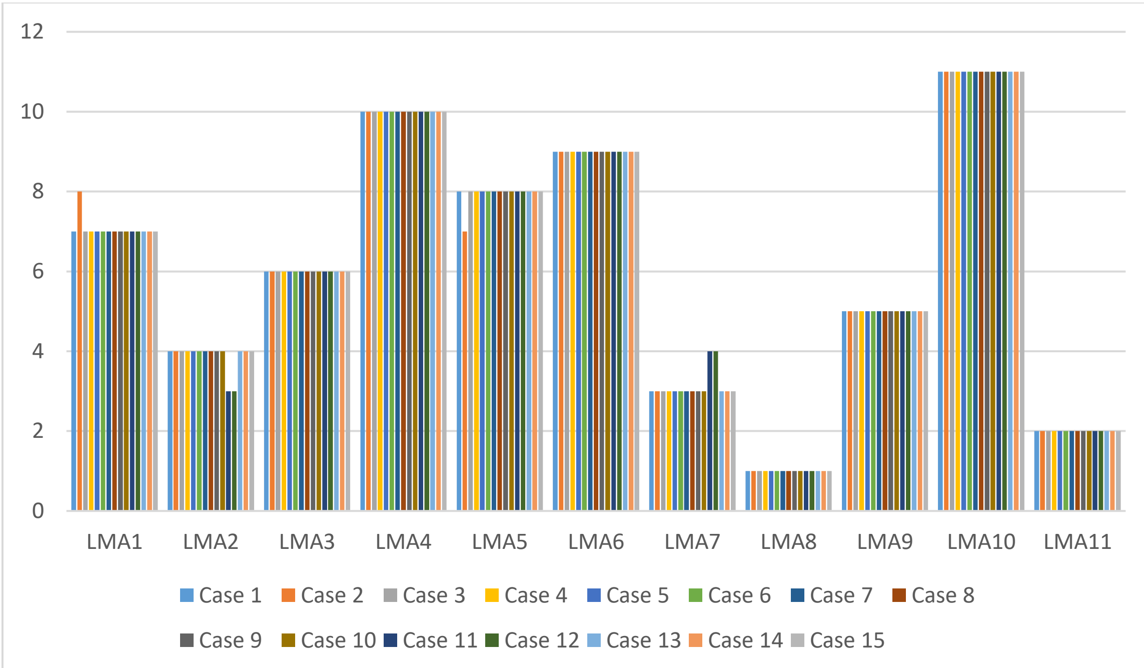

Figure 5. The rank of alternatives under sensitivity analysis.

6. Conclusions

This study proposed a hybrid MCDM methodology to evaluate leadership management strategies in healthcare systems. The MCDM method, such as the COPRAS method, ranks the alternatives. The type-2 neutrosophic sets were used to deal with uncertain information. Three decision-makers are invited in this study to evaluate the criteria and alternatives. This study used 14 criteria and 11 alternatives. Three decision-makers are built on three decision matrices between criteria and alternatives. Decision-makers use linguistic terms to evaluate the requirements and alternatives. Then, the type-2 neutrosophic numbers replace these terms to assess the criteria and alternatives. Then, these decision matrices are aggregated into a single decision matrix. Then, the steps of the COPRAS method are applied to show the rank of other options. The sensitivity analysis was conducted to show the stability of the rank of other possibilities. This study introduced 15 cases of weights. The results show that the rank of other options is stable in different cases. In the future, this proposed methodology can be applied to various decision-making processes. Various MCDM methods, such as VIKOR, TOPSIS, and MABAC, can be used in this study. A comparative analysis can be applied to show the strength of the proposed method.

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Received: Jan 8, 2024. **Accepted**: Apr 30, 2024