POULTRY PRODUCTION AND FEEDING USING FUZZY RANK CORRELATION FOR ASSESSMENT OF MCDM PROBLEMS

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Abstract

Any organisation that intends to accomplish long-term goals must consider the viability of the poultry-raising system vigilantly. The housing and feeding alternatives must be considered as the most important factors when creating a chicken farm. Instead than focusing only on short term profits, the decision making frame work for housing choices should take long term environmental, social and human impacts into account. During the selection process, a number of aspects are taken into account, including housing materials, a location to minimise water stagnancy, vented, adequate area designed for the pen, and run system, space for feeders, and space for water trench. These metrics indicate the home worth in connection to the organisation typical breeding services. However, the choice of a home is frequently made manually on decisions based on experience that are hazy, imprecise and uncertain. To solve this problem, an effective algorithm that might completely remove the obstacle to decision making is required.

Keywords: MCDM-hetagonal neutrosophic Z numbers-resemblance level - rank correlation

1. Introduction

In a nation like India, with a generally high pace of populace development, remain stock administration is viewed as one of the main evaluation components since it assumes a critical part in independent work for the more youthful friends with more noteworthy degrees of scholarly qualifications. It is also deliberated as an employment intervention method for the more youthful technology for the self-employment of the youth. In India, where there is a high domestic demand for poultry, it is among the most significant animals for producing protein-rich meat. As a result, India's poultry manufacturing machinery is transitioning to sophisticated management technology. The fowl raising utilizing further developed control follows focuses on expanding the yields from the perspective of the money manager.

The choice of vulnerability during the time spent lodging and taking care of in stay-stock control is unavoidable in reality, much like other decision-making issues like provider choice or entrant choice, as a result of the fact that the effects of actions aren't exactly known. The further human critical assessment additionally adds to its unpredictability inside the decision-making assessment. To beat this unclearness and unpredictability in dynamic this notices pursuits to suggest a consolidated system under a neutrosophic climate to assess opportunity options as far as the board machines of lodging and taking care of.

The key contributions of this article are as follows:

- The context is deliberately set up to highlight the significance of a feeding, shelter system for efficient, and sustainable chicken farming.
- Two very much coordinated Multi-norms Direction (MCDM) strategies that exchange uncertain information are utilized for a critical issue in India and differentiated.
- Adequate standards and sub-rules for the replacements are provided in order to keep up with precision and stability in choosing the other options.

2. Literature Review

2.1. Poultry farming with commercial method

Raising animals entails a specific set of tasks that can be influenced by biotic and socioeconomic factors. According to Choudhary et al. India has a large collection of relevant genetic material for poultry, including 28 diagnosed breeds with a higher number of mixed or non-descriptive breeds. In a study by Patil et al. comparing the grazing system and stall feeding apparatus for chickens in the Karnataka district of Gulbarga, it was observed that the stall feeding apparatus results in healthier and faster weight gain than the grazing apparatus. In his research on industrial poultry farming in India, Kumar suggested that technology-based devices and purposeful management could help to increase poultry output. increase chicken farming production and close the supply-demand mismatch. Argüello's survey of current trends in hen studies covers pathology, reproduction, milk and cheese production and quality, manufacturing structures, vitamins, hair production, pill expertise, and meat production.

2.2. MCDM (Multi Criteria Decision Making)

In 1965, Zadeh [16] suggested the use of fuzzy units. The notion of fuzzy units later developed steadily during the following years. Atanassov [3] proposed the notion of the "intuitionistic fuzzy set" (IFS). The intuitionistic fuzzy set [IFS] was extended to "interval intuitionistic fuzzy units" [IIFS] using Atanassov and Gargov [4]. Numerous experts have contributed to the study of MCDM, and a significant achievement has been made in the field of fuzzy units. In 1998, Smarandache [11] proposed the neutrosophic set, which was mostly based on Neutrosophy. The neutrosophic concept deals with ambiguous, irrational situations by taking into account the dynamic characteristics of all impediments. In order to cope with unclear, ambiguous, and inconsistent records, Wang et al. [13] established the "single Valued Neutrosophic Set" (SVNS) and suggested numerous features of set-theoretic operators. In [14], Ye [15] defined the rating and accuracy feature of the trapezoidal neutrosophic number, which he presented as an extension of the SVNS and the trapezoidal fuzzy broad variety. The plithogenic set was presented by Smarandache [12] as a generalisation of crisp, fuzzy, intuitionistic fuzzy, and neutrosophic sets. Its elements are demarcated by a set of characteristic values, each with a corresponding contradiction level value between the characteristic cost and the dominant attribute price.

In order to solve a funding employer problem connected to trapezoidal neutrosophic variety, Pramanik and Mallick [10] introduced the VIKOR method. They also modified the funding employer problem from [7] and provided a comparative assessment. For teacher enlistment in higher education, Mondal and Pramanik [9] developed an MCDM method with undetermined weights depending on the rating and accuracy function, hybrid score and accuracy capabilities, and a cut down neutrosophic situation. Biswas et al. [5,6] established a new approach for neutrosophic MCDM with uncertain weight data and a Cosine rebalance measure built entirely on MCDM with trapezoidal fuzzy neutrosophic numbers. Abdel-Basset [1] created the aid smoothing problem to reduce the cost of daily source variation in creative projects underneath neutrosophic conditions in order to overawe the paradox tangible world difficulties. Duarte [2] proposed applying the fuzzy TODIM approach in a multi-criteria selection evaluation to value six Brazilian banks. In this paper a new ranking and method is approached to solve the MCDM using neutrosophic

3. Preliminaries

3.1. Heptagonal Neutrosophic Z numbers (HtNZN)

A heptagonal neutrosophic Z numbers (HtNZN) is defined in a non-empty set X and an unit interval I i.e., [0,1] as $NPZN = \left\{\left\langle x; \langle TR_U(x), ID_U(x), FA_U(x)\rangle \langle TR_R(x), ID_R(x), FA_R(x)\rangle : x \in X \right\rangle\right\}$ where $TR_U(x), TR_R(x),\ ID_U(x), ID_R(x)$, $FA_U(x), FA_R(x) : X \to [0,1]$ denote the level of membership, indeterminacy and non-membership of uncertainty and reliability is given as

$$TR(x) = \begin{cases} 0 & ; for\ x < m \\ \frac{1}{2}\left(\frac{x-m}{n-m}\right) & ; x \in [m, n] \\ \frac{1}{2} & ; x \in [n, \vartheta] \\ \frac{1}{2} + \frac{1}{2}\left(\frac{x-n}{\vartheta - n}\right) & ; x \in [\vartheta, \rho] \\ \frac{1}{2} + \frac{1}{2}\left(\frac{\theta - x}{\theta - \rho}\right) & ; x \in [\rho, \theta] \\ \frac{1}{2} & ; x \in [\theta, \omega] \\ \frac{1}{2}\left(\frac{\varpi - x}{\varpi - \omega}\right), & ; x \in [\omega, \varpi] \\ 0 & ; otherwise \end{cases}$$

$$ID(x) = \begin{cases} 1 & ; for\ x < m'' \\ 1 - \frac{1}{2}\left(\frac{x - m''}{n'' - m''}\right) & ; x \in [m'', n''] \\ \frac{1}{2} & ; x \in [n'', \vartheta''] \\ \frac{1}{2}\left(\frac{x - \vartheta''}{\beta'' - \vartheta''}\right) & ; x \in [\alpha'', \beta''] \\ 0 & ; x = \beta'' \\ \frac{1}{2}\left(\frac{\gamma'' - x}{\gamma'' - \beta''}\right) & ; x \in [\beta'', \gamma''] \\ \frac{1}{2} & ; x \in [\gamma'', \lambda''] \\ 1 - \frac{1}{2}\left(\frac{\mu'' - x}{\mu'' - \lambda''}\right) & ; x \in [\lambda'', \mu''] \\ 1 & otherwise \end{cases}$$

$$FA(x) = \begin{cases} 1 & ; for\ x < m' \\ 1 - \frac{1}{2}\left(\frac{x - m'}{n' - m'}\right) & ; x \in [m', n'] \\ \frac{1}{2} & ; x \in [n', \alpha'] \\ \frac{1}{2}\left(\frac{x - \alpha'}{\beta' - \alpha'}\right) & ; x \in [\alpha', \beta'] \\ 0 & ; x = \beta' \\ \frac{1}{2}\left(\frac{\gamma' - x}{\gamma' - \beta'}\right) & ; x \in [\beta', \gamma'] \\ \frac{1}{2} & ; x \in [\gamma', \lambda'] \\ 1 - \frac{1}{2}\left(\frac{\mu' - x}{\mu' - \lambda'}\right) & ; x \in [\lambda', \mu'] \\ 1 & otherwise \end{cases}$$

3.2. Span between two Heptagonal Neutrosophic Z numbers

Let

$$HtZ_1 = \left\{ \left\langle \begin{matrix} (m_{1U}, n_{1U}, \alpha_{1U}, \beta_{1U}, \gamma_{1U}, \lambda_{1U}, \mu_{1U}) \\ (m''_{1U}, n''_{1U}, \alpha''_{1U}, \beta''_{1U}, \gamma''_{1U}, \lambda''_{1U}, \mu''_{1U}) \\ (m'_{1U}, n'_{1U}, \alpha'_{1U}, \beta'_{1U}, \gamma'_{1U}, \lambda'_{1U}, \mu'_{1U}) \end{matrix} \right\rangle \left\langle \begin{matrix} (m_{1R}, n_{1R}, \alpha_{1R}, \beta_{1R}, \gamma_{1R}, \lambda_{1R}, \mu_{1R}) \\ (m''_{1R}, n''_{1R}, \alpha''_{1R}, \beta''_{1R}, \gamma''_{1R}, \lambda''_{1R}, \mu''_{1R}) \\ (m'_{1R}, n'_{1R}, \alpha'_{1R}, \beta'_{1R}, \gamma'_{1R}, \lambda'_{1R}, \mu'_{1R}) \end{matrix} \right\rangle \right\}$$

and

$$HtZ_2 = \left\{ \left\langle \begin{matrix} (m_{2U}, n_{2U}, \alpha_{2U}, \beta_{2U}, \gamma_{2U}, \lambda_{2U}, \mu_{2U}) \\ (m''_{2U}, n''_{2U}, \alpha''_{2U}, \beta''_{2U}, \gamma''_{2U}, \lambda''_{2U}, \mu''_{2U}) \\ (m'_{2U}, n'_{2U}, \alpha'_{2U}, \beta'_{2U}, \gamma'_{2U}, \lambda'_{2U}, \mu'_{2U}) \end{matrix} \right\rangle \left\langle \begin{matrix} (m_{2R}, n_{2R}, \alpha_{2R}, \beta_{2R}, \gamma_{2R}, \lambda_{2R}, \mu_{2R}) \\ (m''_{2R}, n''_{2R}, \alpha''_{2R}, \beta''_{2R}, \gamma''_{2R}, \lambda''_{2R}, \mu''_{2R}) \\ (m'_{2R}, n'_{2R}, \alpha'_{2R}, \beta'_{2R}, \gamma'_{2R}, \lambda'_{2R}, \mu'_{2R}) \end{matrix} \right\rangle \right\}$$

be two heptagonal neutrosophic Z numbers then the span between HtZ_1 and HtZ_2 is well-defined as follows.

$$L(HtZ_1, HtZ_2) = \frac{1}{18}\left\{ \begin{array}{l} \left\langle \begin{array}{l} |m_{1U} - m_{2U}| + |n_{1U} - n_{2U}| + |\alpha_{1U} - \alpha_{2U}| + |\beta_{1U} - \beta_{2U}| + \\ |\gamma_{1U} - \gamma_{2U}| + |\lambda_{1U} - \lambda_{2U}| + |\mu_{1U} - \mu_{2U}| + |m''_{1U} - m''_{2U}| + \\ |n''_{1U} - n''_{2U}| + |\alpha''_{1U} - \alpha''_{2U}| + |\beta''_{1U} - \beta''_{2U}| + |\gamma''_{1U} - \gamma''_{2U}| + \\ |\lambda''_{1U} - \lambda''_{2U}| + |\mu''_{1U} - \mu''_{2U}| + |m'_{1U} - m'_{2U}| + |n'_{1U} - n'_{2U}| + \\ |\alpha'_{1U} - \alpha'_{2U}| + |\beta'_{1U} - \beta'_{2U}| + |\gamma'_{1U} - \gamma'_{2U}| + |\lambda'_{1U} - \lambda'_{2U}| + |\mu'_{1U} - \mu'_{2U}| \end{array} \right\rangle \\ \left\langle \begin{array}{l} |m_{2R} - m_{2R}| + |n_{1R} - n_{2R}| + |\alpha_{1R} - \alpha_{2R}| + |\beta_{1R} - \beta_{2R}| + \\ |\gamma_{1R} - \gamma_{2R}| + |\lambda_{1R} - \lambda_{2R}| + |\mu_{1R} - \mu_{2R}| + |m''_{1R} - m''_{2R}| + \\ |n''_{1R} - n''_{2R}| + |\alpha''_{1R} - \alpha''_{2R}| + |\beta''_{1R} - \beta''_{2R}| + |\gamma''_{1R} - \gamma''_{2R}| + \\ |\lambda''_{1R} - \lambda''_{2R}| + |\mu''_{1R} - \mu''_{2R}| + |m'_{1R} - m'_{2R}| + |n'_{1R} - n'_{2R}| + \\ |\alpha'_{1R} - \alpha'_{2R}| + |\beta'_{1R} - \beta'_{2R}| + |\gamma'_{1R} - \gamma'_{2R}| + |\lambda'_{1R} - \lambda'_{2R}| + |\mu'_{1R} - \mu'_{2R}| \end{array} \right\rangle \end{array} \right\} \quad \text{----->} (2)$$

3.3. Resembalance Level between two Heptagonal Neutrosophic Z numbers

Let

$$HtZ_1 = \left\{ \left\langle \begin{array}{l} (m_{1U}, n_{1U}, \alpha_{1U}, \beta_{1U}, \gamma_{1U}, \lambda_{1U}, \mu_{1U}) \\ (m''_{1U}, n''_{1U}, \alpha''_{1U}, \beta''_{1U}, \gamma''_{1U}, \lambda''_{1U}, \mu''_{1U}) \\ (m'_{1U}, n'_{1U}, \alpha'_{1U}, \beta'_{1U}, \gamma'_{1U}, \lambda'_{1U}, \mu'_{1U}) \end{array} \right\rangle \left\langle \begin{array}{l} (m_{1R}, n_{1R}, \alpha_{1R}, \beta_{1R}, \gamma_{1R}, \lambda_{1R}, \mu_{1R}) \\ (m''_{1R}, n''_{1R}, \alpha''_{1R}, \beta''_{1R}, \gamma''_{1R}, \lambda''_{1R}, \mu''_{1R}) \\ (m'_{1R}, n'_{1R}, \alpha'_{1R}, \beta'_{1R}, \gamma'_{1R}, \lambda'_{1R}, \mu'_{1R}) \end{array} \right\rangle \right\}$$

and

$$HtZ_2 = \left\{ \left\langle \begin{array}{l} (m_{2U}, n_{2U}, \alpha_{2U}, \beta_{2U}, \gamma_{2U}, \lambda_{2U}, \mu_{2U}) \\ (m''_{2U}, n''_{2U}, \alpha''_{2U}, \beta''_{2U}, \gamma''_{2U}, \lambda''_{2U}, \mu''_{2U}) \\ (m'_{2U}, n'_{2U}, \alpha'_{2U}, \beta'_{2U}, \gamma'_{2U}, \lambda'_{2U}, \mu'_{2U}) \end{array} \right\rangle \left\langle \begin{array}{l} (m_{2R}, n_{2R}, \alpha_{2R}, \beta_{2R}, \gamma_{2R}, \lambda_{2R}, \mu_{2R}) \\ (m''_{2R}, n''_{2R}, \alpha''_{2R}, \beta''_{2R}, \gamma''_{2R}, \lambda''_{2R}, \mu''_{2R}) \\ (m'_{2R}, n'_{2R}, \alpha'_{2R}, \beta'_{2R}, \gamma'_{2R}, \lambda'_{2R}, \mu'_{2R}) \end{array} \right\rangle \right\}$$

be two heptagonal neutrosophic Z numbers and let

$$HtZ^{c}_{2} = \left\{ \begin{array}{l} \left\langle \begin{array}{l} (m'_{2U}, n'_{2U}, \alpha'_{2U}, \beta'_{2U}, \gamma'_{2U}, \lambda'_{2U}, \mu'_{2U}) \\ (1 - m''_{2U}, 1 - n''_{2U}, 1 - \alpha''_{2U}, 1 - \beta''_{2U}, 1 - \gamma''_{2U}, 1 - \lambda''_{2U}, 1 - \mu''_{2U}) \\ (m_{2U}, n_{2U}, \alpha_{2U}, \beta_{2U}, \gamma_{2U}, \lambda_{2U}, \mu_{2U}) \end{array} \right\rangle \\ \left\langle \begin{array}{l} (m'_{2R}, n'_{2R}, \alpha'_{2R}, \beta'_{2R}, \gamma'_{2R}, \lambda'_{2R}, \mu'_{2R}) \\ (1 - m''_{2R}, 1 - n''_{2R}, 1 - \alpha''_{2R}, 1 - \beta''_{2R}, 1 - \gamma''_{2R}, 1 - \lambda''_{2R}, 1 - \mu''_{2R}) \\ (m_{2R}, n_{2R}, \alpha_{2R}, \beta_{2R}, \gamma_{2R}, \lambda_{2R}, \mu_{2R}) \end{array} \right\rangle \end{array} \right\}$$

be the complement of HtZ_2 then the level of resemblance between HtZ_1 and HtZ_2 is defined as follows.

$$\varpi(HtZ_1, HtZ_2) = \left\{ \frac{L(HtZ_1, HtZ^{C}_{2})}{L(HtZ_1, HtZ_2) + L(HtZ_1, HtZ^{C}_{2})} \right\} \quad \text{------>} (3)$$

3.4. Heptagonal Neutrosophic Z Decision Matrix

Let $\tilde{\Re} = \left(Ht\tilde{Z}_{ij}\right)_{mxn}$ if all $\left(Ht\tilde{Z}_{ij}\right)_{mxn}$ are heptagonal neutrosophic number then

$$\tilde{\Re} = \left(Ht\tilde{Z}_{ij}\right) = \left\{ \left\langle \begin{array}{l} (\tilde{m}_{Uij}, \tilde{n}_{Uij}, \tilde{\alpha}_{Uij}, \tilde{\beta}_{Uij}, \tilde{\gamma}_{Uij}, \tilde{\lambda}_{Uij}, \tilde{\mu}_{Uij}) \\ (\tilde{m}''_{Uij}, \tilde{n}''_{Uij}, \tilde{\alpha}''_{Uij}, \tilde{\beta}''_{Uij}, \tilde{\gamma}''_{Uij}, \tilde{\lambda}''_{Uij}, \tilde{\mu}''_{Uij}) \\ (\tilde{m}'_{Uij}, \tilde{n}'_{Uij}, \tilde{\alpha}'_{Uij}, \tilde{\beta}'_{Uij}, \tilde{\gamma}'_{Uij}, \tilde{\lambda}'_{Uij}, \tilde{\mu}'_{Uij}) \end{array} \right\rangle \left\langle \begin{array}{l} (\tilde{m}_{Rij}, \tilde{n}_{Rij}, \tilde{\alpha}_{Rij}, \tilde{\beta}_{Rij}, \tilde{\gamma}_{Rij}, \tilde{\lambda}_{Rij}, \tilde{\mu}_{Rij}) \\ (\tilde{m}''_{Rij}, \tilde{n}''_{Rij}, \tilde{\alpha}''_{Rij}, \tilde{\beta}''_{Rij}, \tilde{\gamma}''_{Rij}, \tilde{\lambda}''_{Rij}, \tilde{\mu}''_{Rij}) \\ (\tilde{m}'_{Rij}, \tilde{n}'_{Rij}, \tilde{\alpha}'_{Rij}, \tilde{\beta}'_{Rij}, \tilde{\gamma}'_{Rij}, \tilde{\lambda}'_{Rij}, \tilde{\mu}'_{Rij}) \end{array} \right\rangle \right\}$$

Is a heptagonal neutrosophic Z decision matrix.

4. Proposed Method To Solve Heptagonal Neutrosophic Z MCDM:

The steps for solving the heptagonal neutrosopic Z MCDM problem are as follows:

Step 1: Utilize the decision-information maker's about the alternatives that meet the criteria to build a decision matrix with dimensions. The decision maker's designation of the heptagonal neutrosophc Z decision matrix is defined as follows.

$$\Re = \begin{bmatrix} \left\langle \begin{matrix} (m_{U11}; n_{U11}; \alpha_{U11}; \beta_{U11}; \gamma_{U11}; \lambda_{U11}; \mu_{U11}) \\ (m''_{U11}; n''_{U11}; \alpha''_{U11}; \beta''_{U11}; \gamma''_{U11}; \lambda''_{U11}; \mu''_{U11}) \\ (m'_{U11}; n'_{U11}; \alpha'_{U11}; \beta'_{U11}; \gamma'_{U11}; \lambda'_{U11}; \mu'_{U11}) \end{matrix} \right\rangle & \cdots\cdots\cdots & \left\langle \begin{matrix} (m_{U1n}; n_{U1n}; \alpha_{U1n}; \beta_{U1n}; \gamma_{U1n}; \lambda_{U1n}; \mu_{U1n}) \\ (m''_{U1n}; n''_{U1n}; \alpha''_{U1n}; \beta''_{U1n}; \gamma''_{U1n}; \lambda''_{U1n}; \mu''_{U1n}) \\ (m'_{U1n}; n'_{U1n}; \alpha'_{U1n}; \beta'_{U1n}; \gamma'_{U1n}; \lambda'_{U1n}; \mu'_{U1n}) \end{matrix} \right\rangle \\ \left\langle \begin{matrix} (m_{R11}; n_{R11}; \alpha_{R11}; \beta_{R11}; \gamma_{R11}; \lambda_{R11}; \mu_{R11}) \\ (m''_{R11}; n''_{R11}; \alpha''_{R11}; \beta''_{R11}; \gamma''_{R11}; \lambda''_{R11}; \mu''_{R11}) \\ (m'_{R11}; n'_{R11}; \alpha'_{R11}; \beta'_{R11}; \gamma'_{R11}; \lambda'_{R11}; \mu'_{R11}) \end{matrix} \right\rangle & & \left\langle \begin{matrix} (m_{R1n}; n_{R1n}; \alpha_{R1n}; \beta_{R11}; \gamma_{R1n}; \lambda_{R1n}; \mu_{R1n}) \\ (m''_{R1n}; n''_{R1n}; \alpha''_{R1n}; \beta''_{R1n}; \gamma''_{R1n}; \lambda''_{R1n}; \mu''_{R1n}) \\ (m'_{R1n}; n'_{R1n}; \alpha'_{R1n}; \beta'_{R1n}; \gamma'_{R1n}; \lambda'_{R1n}; \mu'_{R1n}) \end{matrix} \right\rangle \\ \vdots & \vdots\ \vdots\ \vdots & \vdots \\ \left\langle \begin{matrix} (m_{Um1}; n_{Um1}; \alpha_{Um1}; \beta_{Um1}; \gamma_{Um1}; \lambda_{Um1}; \mu_{Um1}) \\ (m''_{Um1}; n''_{Um1}; \alpha''_{Um1}; \beta''_{Um1}; \gamma''_{Um1}; \lambda''_{Um1}; \mu''_{Um1}) \\ (m'_{Um1}; n'_{Um1}; \alpha'_{Um1}; \beta'_{Um1}; \gamma'_{Um1}; \lambda'_{Um1}; \mu'_{Um1}) \end{matrix} \right\rangle & & \left\langle \begin{matrix} (m_{Umn}; n_{Umn}; \alpha_{Umn}; \beta_{Umn}; \gamma_{Umn}; \lambda_{Umn}; \mu_{Umn}) \\ (m''_{Umn}; n''_{Umn}; \alpha''_{Umn}; \beta''_{Umn}; \gamma''_{Umn}; \lambda''_{Umn}; \mu''_{Umn}) \\ (m'_{Umn}; n'_{Umn}; \alpha'_{Umn}; \beta'_{Umn}; \gamma'_{Umn}; \lambda'_{Umn}; \mu'_{Umn}) \end{matrix} \right\rangle \\ \left\langle \begin{matrix} (m_{Rm1}; n_{Rm1}; \alpha_{Rm1}; \beta_{Rm1}; \gamma_{Rm1}; \lambda_{Rm1}; \mu_{Rm1}) \\ (m''_{Rm1}; n''_{Rm1}; \alpha''_{Rm1}; \beta''_{Rm1}; \gamma''_{Rm1}; \lambda''_{Rm1}; \mu''_{Rm1}) \\ (m'_{Rm1}; n'_{Rm1}; \alpha'_{Rm1}; \beta'_{Rm1}; \gamma'_{Rm1}; \lambda'_{Rm1}; \mu'_{Rm1}) \end{matrix} \right\rangle & & \left\langle \begin{matrix} (m_{Rmn}; n_{Rmn}; \alpha_{Rmn}; \beta_{Rmn}; \gamma_{Rmn}; \lambda_{Rmn}; \mu_{Rmn}) \\ (m''_{Rmn}; n''_{Rmn}; \alpha''_{Rmn}; \beta''_{Rmn}; \gamma''_{Rmn}; \lambda''_{Rmn}; \mu''_{Rmn}) \\ (m'_{Rmn}; n'_{Rmn}; \alpha'_{Rmn}; \beta'_{Rmn}; \gamma'_{Rmn}; \lambda'_{Rmn}; \mu'_{Rmn}) \end{matrix} \right\rangle \end{bmatrix}$$

Step 2: Discover the combined heptagonal neutrosophc Z decision matrix of each decision maker in step two. The definition of the combined heptagonal neutrosophc Z decision matrix $\tilde{\Re} = \left(Ht\tilde{Z}_{ij} \right)_{mxn}$ is shown below.

$$\left(\grave{H}\tilde{t}Z_{ij} \right) = \left\{ \left\langle \begin{matrix} (\tilde{m}_{Uij}, \tilde{n}_{Uij}, \tilde{\alpha}_{Uij}, \tilde{\beta}_{Uij}, \tilde{\gamma}_{Uij}, \tilde{\lambda}_{Uij}, \tilde{\mu}_{Uij}) \\ (\tilde{m}''_{Uij}, \tilde{n}''_{Uij}, \tilde{\alpha}''_{Uij}, \tilde{\beta}''_{Uij}, \tilde{\gamma}''_{Uij}, \tilde{\lambda}''_{Uij}, \tilde{\mu}''_{Uij}) \\ (\tilde{m}'_{Uij}, \tilde{n}'_{Uij}, \tilde{\alpha}'_{Uij}, \tilde{\beta}'_{Uij}, \tilde{\gamma}'_{Uij}, \tilde{\lambda}'_{Uij}, \tilde{\mu}'_{Uij}) \end{matrix} \right\rangle \left\langle \begin{matrix} (\tilde{m}_{Rij}, \tilde{n}_{Rij}, \tilde{\alpha}_{Rij}, \tilde{\beta}_{Rij}, \tilde{\gamma}_{Rij}, \tilde{\lambda}_{Rij}, \tilde{\mu}_{Rij}) \\ (\tilde{m}''_{Rij}, \tilde{n}''_{Rij}, \tilde{\alpha}''_{Rij}, \tilde{\beta}''_{Rij}, \tilde{\gamma}''_{Rij}, \tilde{\lambda}''_{Rij}, \tilde{\mu}''_{Rij}) \\ (\tilde{m}'_{Rij}, \tilde{n}'_{Rij}, \tilde{\alpha}'_{Rij}, \tilde{\beta}'_{Rij}, \tilde{\gamma}'_{Rij}, \tilde{\lambda}'_{Rij}, \tilde{\mu}'_{Rij}) \end{matrix} \right\rangle \right\}$$

where $\left(\grave{H}\tilde{t}Z \right) = \frac{1}{t} \sum_{k=1}^{t} Ht\tilde{Z}_{ij}(k)$

Step 3: Determine the span for each $(\tilde{\Re}, \grave{\tilde{\Re}})$ using equation (2)

Step 4: Determine the level of resemblance between $H\tilde{t}Z_1$ and $\grave{H}\tilde{t}Z_2$ using

Step 5: Determine the score value using the equation

$$S(HtZ) = \frac{1}{3} \begin{bmatrix} 2 + \frac{m_U + n_U + \alpha_U + \beta_U + \gamma_U + \lambda_U + \mu_U}{7} - \\ \frac{m''_U + n''_U + \alpha''_U + \beta''_U + \gamma''_U + \lambda''_U + \mu''_U}{7} - \\ \frac{m'_U + n'_U + \alpha'_U + \beta'_U + \gamma'_U + \lambda'_U + \mu'_U}{7} \end{bmatrix} \begin{bmatrix} 2 + \frac{m_R + n_R + \alpha_R + \beta_R + \gamma_R + \lambda_R + \mu_R}{7} - \\ \frac{m''_R + n''_R + \alpha''_R + \beta''_R + \gamma''_R + \lambda''_R + \mu''_R}{7} - \\ \frac{m'_R + n'_R + \alpha'_R + \beta'_R + \gamma'_R + \lambda'_R + \mu'_R}{7} \end{bmatrix} \quad \text{------>}\ (4)$$

Step 6: Calculate the span for aggregated decision matrix using equation (2)

Step 7: Use rank correlation for heptagonal neutrosophc Z decision matrix of all alternatives and criteria's

Step 8: The ranking order for MCDM is made to find the best alternative and criteria.

5. Case Study

For the suggested multi-criteria group decision-making process, a case study is presented. This has to do with figuring out the optimum technique for housing and feeding chickens in the current poultry farms so that they develop more healthily, put on more weight, and are safer overall. Three decision-makers (D1, D2 and D3) are asked to evaluate the four alternatives (A1 to A4) in light of the four criteria (C1 to C4) they established in order to do so. The following is a representation of these criteria and their definitions:

Alternatives:

IS - Stall feeding apparatus and regular flooring (intensive system)
ES - Grazing method (extensive system)
GS - barn with an elevated floor and a rotating grazing system
IEGS - both an element of the extensive and the intense grazing systems

Following a quick evaluation of the prior literature review and consultation with the experts, the consideration of the criterion and sub-criteria are listed below.

Criteria:

CR1 - needs for floor planetary,
CR2 - Space requirements for feeding (Feeder) and irrigating
CR3 - Space needed for watering and feeding (Feeder),
CR4 - Efficiency

The subject matter experts are given a questionnaire that has been produced. These experts also assigned a grade to the statement's level, which is listed under.

Table 1: Grading measure by specialists

Statement	Very high	High	Fair	Average	Medium	Satisfactory	Low	Very low	Not sure
Score	.9	.8	.7	.6	.5	.4	.3	.2	.1

Solution.

Step 1. When presenting the choices under the four criteria, the three decision-makers used heptagonal neutrosophic Z numbers.

Step 2: Normalize the heptagonal neutrosophic Z decision matrix $\tilde{\Re} = \left(Ht\tilde{Z}_{ij} \right)_{mxn}$ is calculated based on experts D_k .

Step 3: Consider the substitute $A1$ of $DM1$ and the norms $CR1$

Step 4: Calculate the span among A_1 *and* A_1' , A_1 *and* $A_1'^{C}$ of DM_1

$CR_1 =$
{[(.0,.1,.2,.3,.4,.5,.6)(.1,.1,.1,.1,.1,.1,.0)(.1,.5,.6,.7,.8,.9,.9)][(.0,.1,.2,.3,.4,.5,.6)(.0,.1,.1,.1,.1,.1,.1)(.1,.5,.6,.7,.8,.9,.9)]}

CR_1'
={[(.0,.3,.4,.4,.5,.6,.6)(.0,.1,.1,.2,.2,.3,.3)(.0,.4,.5,.6,.6,.7,.7)][(.0,.3,.4,.4,.5,.6,.6)(.0,.1,.1,.2,.2,.3,.3)(.0,.4,.5,.6,.6,.7,.7)]}

$C_1'^C$ ={
[(.0,.4,.5,.6,.6,.7,.7)(.0,.9,.9,.8,.8,.7,.7)(.0,.3,.4,.4,.5,.6,.6)][(.0,.4,.5,.6,.6,.7,.7)(.0,.9,.9,.8,.8,.7,.7)(.1,.3,.4,.4,.5,.6,.6)]}

$L(C_1, C_1') = (1/18)\ (2.2)\ (2.2)$; $L(C_1, C_1'^C) = (1/18)\ (6.9)\ (6.9)$

Step 5: The level of resemblance among A_1 *and* A' is defined as follows

$$\varpi(C_1, C_1') = \left\{\frac{L(C_1, C_1')}{L(C_1, C_1') + L(C_1, C_1'^C)}\right\} = \left[\frac{\frac{1}{18}(6.9)}{\frac{1}{18}[2.2+6.9]}, \frac{\frac{1}{18}(6.9)}{\frac{1}{18}[2.2+6.9]}\right] = (0.76, 0.76)$$

Heptagonal neutrosophic Z number was used to present the judgement of the three decision makers for the options underneath the four criteria, as shown in Table.

Table 2: Level of resembalance between the substitutes compared with the norms

Level of Resembalance	**A1 of DM1**	**A2 of DM1**	**A3 of DM1**	**A4 of DM1**	**A1 of DM2**	**A2 of DM2**	**A3 of DM2**	**A4 of DM2**	**A1 of DM3**	**A2 of DM3**	**A3 of DM3**	**A4 of DM3**
ϖ (C_1 , C_1□)	(0.76, 0.76)	(0.70, 0.70)	(0.76, 0.76)	(0.68, 0.68)	(0.56, 0.56)	(0.69, 0.69)	(0.66, 0.66)	(0.51, 0.51)	(0.77, 0.77)	(0.77, 0.77)	(0.66, 0.66)	(0.42, 0.42)
ϖ ($C1$, $C2$)	(,0.68, 0.68)	(0.53, 0.53)	(0.53, 0.53)	(0.57, 0.57)	(0.74, 0.74)	(0.56, 0.56)	(0.50, 0.50)	(0.81, 0.81)	(0.45, 0.45)	(0.57, 0.57)	(0.59, 0.59)	(0.72, 0.72)
ϖ ($C3$, $C3$)	(0.66, 0.66)	(0.61, 0.61)	(0.60, 0.60)	(0.48, 0.48)	(0.54, 0.54)	(0.61, 0.61)	(0.38, 0.38)	(0.65, 0.65)	(0.72, 0.72)	(0.83, 0.83)	(0.56, 0.56)	(0.45, 0.45)
ϖ (C_4 , C_4□)	(0.62, 0.62)	(0.57, 0.57)	(0.81, 0.81)	(0.50, 0.50)	(,0.68, 0.68	(0.78, 0.78)	(0.80, 0.80)	(0.51, 0.51)	(0.44, 0.44)	(0.54, 0.54)	(0.80, 0.80)	(0.45, 0.45)

Step 5: Using equation (1) HNWA the accumulated judgement matrix is calculated.

$$\begin{array}{c} S(A) = CR1 \quad CR2 \quad CR3 \quad CR4 \\ \begin{array}{c} A1 \\ A2 \\ A3 \\ A4 \end{array} \begin{bmatrix} .59 & .48 & .48 & .62 \\ .49 & .47 & .65 & .66 \\ .58 & .54 & .56 & .73 \\ .55 & .64 & .67 & .54 \end{bmatrix} \end{array}$$

Step 6: Calculate the cut off using the equation (4)

Step 7: Then the world-wide rank value of each *Ai* can be designed using rank correlation for four different criteria's and attributes. Comparison for each pair of attributes are made and the results are given below. ρ($A1$,$A2$) = .6, ρ ($A1$, $A3$) = .9, ρ ($A1$, $A4$) = -.9, ρ ($A2$,$A3$) = -.8, ρ ($A2$,$A4$) = -.4, ρ ($A3$,$A4$) = -.8. From the comparison the result show that the alternatives $A1$ and $A3$ are nearest to +1 and so the pair A_1 and A_3 has the nearest approach.

6. Conclusion

This study is an observational evaluation of the sustainability of industrial chicken farming and its current effects on children's self-employment in an environment characterised by MCDM techniques. Using the aforementioned techniques, three experts evaluate the social, financial, and ecological sustainability of poultry farming's housing and feeding systems, and the results are then treated as heptagonal neutrosophic Z numbers to eradicate the paradox and improve the exactness of the decision-making process. It is assessed with the suggested method, which may distinguish amid risk-based opportunity and targeted opportunity in ambiguous scenarios. At the same time, the ranking is completed depending entirely on the distance between each option and its excellent and undesirable perfect solutions. As a result, it is clear that stall feeding systems with standard floors and components with both large and enormous grazing machines are highly desirable for environmentally friendly commercial poultry farming. This analysis can be used in a variety of other domains, including the economics of poultry farming and other industries involving farm animals, as well as cattle control systems with era adaptation.

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