



Relevance of the Obstacles to the Achievement of Food Sovereignty in Ecuador, Analysis through the Neutrosophic Soft Set

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Abstract. One of the elements addressed in the Sustainable Development Goals until 2030, is the achievement of food sovereignty. This important issue takes relevance in the debates at the level of states, among which is Ecuador, which recognizes it as a right to its citizens from its Magna Carta. Despite being a widely addressed topic and to which substantial resources are destined, obstacles persist in its implementation. Therefore, it is proposed as the objective of this investigation: the analysis of the relevance of obstacles to the achievement of food sovereignty in Ecuador through Neutrosophic Soft Sets. To meet the proposed objective, empirical methods such as the interview and a neutrosophic soft set model were used. As a result, it was obtained that from the four initial statements, only three were true and that their relevance in the subject addressed was given by the following hierarchy: first of all the need to guarantee vulnerable groups the right to healthy eating, second, the fact that the allocations of resources to peasant producers are scarce in order to increase food production in the area and finally, the insufficient legal framework to guarantee the right to food sovereignty of Ecuadorians, in correspondence with the international pronouncements and The Constitution.

Keywords: food sovereignty, neutrosophic soft set.

1 Introduction

Food sovereignty is the right of peoples, countries, or unions of states to define their agricultural and food policy, without dumping (too cheap agricultural and food imports) against third countries. In addition, it prioritizes a reform and participation of agrarian policies that support local agricultural production to feed the population; the right and access of peasants to use the soil to sow, access to credit, water, non-genetically modified seeds; the right of consumers to be able to decide what they want to eat; recognize farmers because they have a fundamental role in agricultural production and food [1].

With food security, not only access to food is required, but also the right to the means necessary for its production (mainly land, water, and seeds). Such redistribution of the means of production towards the peasantry is justified by its preponderant role in guaranteeing the right to food for all. It implies an ambiguous definition of the privileged productive subjects and how and where food should be produced and distributed.

The food sovereignty approach explicitly favors agroecological production, on a small and medium scale, through diversified and healthy agriculture, rooted in the territories, that offer quality and culturally appropriate food to local food systems, at the expense of long chains. This approach opposes, therefore, agro-industrial monocultures and the intensive use of chemical inputs, as well as, in general, the homologous logic of the corporate regime that subjects the production and consumption of food to the processes of accumulation of capital. The intention is to reduce the gap between producers and consumers and guarantee food quality linked not only to nutritional properties but also to the social and environmental impacts of production processes [2].

The production and export of food in Latin America contribute significantly to national economies, but it also creates dependency and brings economic, environmental, and social problems. Negative impacts on public health, the integrity of ecosystems, food quality, and in many cases, disrupt traditional rural livelihoods, by accelerating the indebtedness of thousands of farmers [3]. Despite innovations and technologies in a globalized economy, the current system of agriculture has failed to prevent widespread hunger and boost the well-being of some communities.

This is why Ecuador incorporates food sovereignty in its Constitutional Magna Carta as a fundamental right

of Ecuadorians in 2008 [4]. The government's efforts to comply with legal regulations and monitor all the established dimensions that took advantage of the international concept have become a challenge within its public policies [5]. However, they are not exempt from difficulties and obstacles to guarantee this right. Like any phenomenon that occurs in practical life, its analysis cannot be rigid, but must also consider the uncertainty in each fact.

In reality, there are many more situations that for various reasons introduce indeterminacy and uncertainty to the information, making it uncertain and not unique, but hesitant or alternative. Disciplines such as image processing, artificial intelligence, applied physics, social sciences, and topology also suffer from the same problems [6]. Numerous applications can be made from neutrosophy to real life and specifically, the soft set, among which are the legal and social sciences.

The classic soft set is based on a certain function (whose values are certain and unique), they were heard of in the investigations carried out by Professor Molodtsov in 1999 [7], then the studies were extended, giving way to the Neutrosophic Soft Set of 2013. The first are deterministic since the set of parameters on which the evaluations are based are deterministic, although they generalize the definition of fuzzy sets. These investigations arise because there is not always total certainty in the evidence that is handled, there may be several points of view that sometimes may even be contrary, lack of information or that is incomplete due to various causes, the lack of witnesses, the hesitant opinion of one of the factors involved in the process, among other reasons [8], [19].

Neutrosophy arises to deal with decision-making problems that involve human knowledge, which frequently has uncertainty, indeterminacy, and inconsistency in information, this is a tool to represent those inconsistencies and contradictions that undoubtedly exist in the processing of evidence within the social sciences and everyday life [9]. Neutrosophic sets are characterized by a truth membership function (t), an indeterminacy membership function (i), and a falsehood membership function (f) independently, which lie within the real unit interval $[-0, 1+]$ standard or not standard. Neutrosophic Sets (NS) proposed by Smarandache are a powerful mathematical tool to handle incomplete, indeterminate, and inconsistent information in the real world [10].

When triads of truth values are assigned to the possible values of the obtained sets, meaning membership, non-membership, and indeterminacy, soft set theory is combined with that of neutrosophic sets to obtain greater precision in the results [11], [17]. This situation can be modeled by operators that have some degree of indeterminacy due to the imprecision that exists in the world. They are a generalization of fuzzy set theory, intuitionistic fuzzy sets, and interval-valued intuitionistic fuzzy sets.

Due to the above, the objective of this research is to analyze the relevance of the obstacles to the achievement of food sovereignty in Ecuador through the neutrosophic soft set.

2 Materials and methods

2.1 Empirical methods

Interviews: will be applied to the sample made up of selected experts. Structured interviews were prepared aimed at obtaining information on the real problem, to obtain valid conclusions and support the results.

Observation: to check how the phenomenon under investigation behaves.

Selection of experts: the competencies of potential experts are checked. For this, a competency validation survey is applied where the degree of knowledge that said potential expert has about the subject and its degree of influence on each of the sources of argumentation is carried out through self-assessments, on an ascending scale of 1 to 10 [12]. The processing of the form was based on the calculation of the rating factor of the experts through the following mathematical expression:

$$K = ((FA + GC)) / = [((SI + EP + IR + FB)) / 4 + GC] / 2 \quad (1)$$

Where:

Si= intuition

PS=Practical Experience IR= Research conducted FB=Consultation of bibliography CG: degree of knowledge (1-10)

| | |
|---------|----------------|
| K value | Classification |
| 8-10 | Tall |
| 5-7 | Medium |
| 1-4 | Bass |

2.2 Neutrosophic Soft Set

Let U , be a universe of situations, H a non-empty subset of U , and $P(H)$ the power function of H . Let a be an attribute and A a set of these attribute values.

A function $F: A \rightarrow P(H)$ is called an indeterminate or soft function if: $F: A \rightarrow P(H)$

- i. The set A has some indeterminacy;
- ii. or $P(H)$ has some indeterminacy;
- iii. or there exists at least one attribute value $v \in A$, such that $F(v) = \text{indeterminate}$ (unclear, uncertain, or not unique);
- iv. or two or the three previous situations.

The neutrosophic soft set is defined as the soft set where F (perhaps) or F (indeterminate), etc, is roughly equivalent to F (yes), F (no), F (true), or F (false), associated with a triad of values (α, β, γ) , where $(\alpha, \beta, \gamma) \in [0, 1]^3$ are the degrees of truth, indeterminacy, and falsehood, respectively [13, 14].

From the previously discussed, the following neutrosophic triplet can be formed [13], [18]:

- i. (Classical) function, which is a well-defined (inner-defined) function for all elements in its domain of definition, or $(T, I, F) = (1, 0, 0)$.
- ii. Neutrofunction (or neutrosophic function), is a function that is partially well defined (degree of truth T), partially indeterminate (degree of indeterminacy I), and partially externally defined (degree of falsehood F) in its domain of definition, where $(T, I, F) \in \{(1, 0, 0), (0, 0, 1)\}$.

Definition 1 [13]: let U be a universe of situations, H is a non-empty subset of U , with $P(H)$ the power set of H , and an attribute, with its set of attribute values, is denoted by A . Then the pair (F, H) , where $f: A \rightarrow P(H)$, is called classic soft set on H .

Definition 2 [13]: If the function $F: A \rightarrow P(H)$, where for each $x \in A$, $f(x) \in P(H)$ and $f(x)$ is true and unique, it is called a determinate (classical) function.

2.3 Model based on Neutrosophic Sof Sets

Starting from a group of statements or sentences that will be denoted by $A = \{a_1, a_2, \dots, a_k\}$, which must be classified or evaluated by the specialists that belong to the group of experts chosen for the study $E = \{e_1, e_2, \dots, e_l\}$. The set of parameters to be measured is given by $C = \{\text{Yes}, \text{No}\}$, where "yes" means that for the expert, the statement is positive, while "no" means the opposite. [15], [20], [21], [22], [23]

The algorithm to follow is:

1. A group of statements is compiled whose veracity and relevance in the legal context are to be determined. These will be denoted by $A = \{a_1, a_2, \dots, a_k\}$.

A group of experts or specialists are convened, who must issue a criterion regarding the veracity or relevance of the statements described. This is known as $E = \{e_1, e_2, \dots, e_l\}$ set.

2. The expert (e_j) is asked to give his opinion on the statement a_i about truthfulness and relevance Expert (e_j) is asked to rate the truth of the statement and its relevance on a scale of 0 to 100. This value is called α_{ij}
 - 2.2. Expert (e_j) is asked to give an evaluation of the falsehood and irrelevance of the statement on a scale of 0 to 100. This value is called γ_{ij}
 - 2.3. Expert (e_j) is asked to assess the uncertainty and irrelevance of the situation on a scale of 0 to 100. This value is called β_{ij}

As a result, you get the following triad:

$$R_{ij} = \langle \alpha_{ij}/100, \beta_{ij}/100, \gamma_{ij}/100 \rangle \quad (2)$$

This is the triad of truth values between 0 and 1, to evaluate the degrees of truth, indeterminacy, and falsehood, respectively, of the relevance of the i -th test according to the j -th expert.

3. The Soft Set is formed by $F: A \rightarrow P(H)$, where $A = \{yes, no\}$, as follows:

$$F(yes) = \{(a_i, e_j, R_{ij}), \text{where } R_{ij} \neq \langle 0, \tau, 1 \rangle, \tau \geq 0\}, \quad (3)$$

while:

$$F(no) = \{(a_i, e_j, R_{ij}), \text{where } R_{ij} \neq \langle 1, 0, 0 \rangle\} \quad (4)$$

4. The final results for tests or evidence are obtained from:

$$G(yes) = \{(a_i, \wedge_j R_{ij}) : j \in \{1, 2, \dots, l\} \text{ such that } (a_i, e_j, R_{ij}) \in F(yes)\} \quad (5)$$

Where, (6) $\llbracket \wedge_j R \rrbracket_{ij} = \langle \min_j \{\alpha_{ij}/100\}, \max_j \{\beta_{ij}/100\}, \max_j \{\gamma_{ij}/100\} \rangle$

$$G(no) = \{(a_i, \wedge_j NOT(R_{ij})) : j \in \{1, 2, \dots, l\} \text{ such that } (a_i, e_j, R_{ij}) \in F(no)\} \quad (7)$$

Where, $\llbracket NOT(R) \rrbracket_{ij} = \langle \gamma_{ij}/100, \beta_{ij}/100, \alpha_{ij}/100 \rangle$

5. For each proof or evidence s_i , select between $G(yes)$ and $G(no)$ the triad that meets the following requirements.

5.1 If a_i is in $G(yes)$ and is not in $G(no)$, then this statement is determined to be true or relevant, with a truth value determined by $\bar{R}_i = \wedge_j R_{ij}$.

5.2 If a_i is in $G(no)$ and is not in $G(yes)$, then this statement is determined to be true or relevant, with a truth value determined by $\tilde{R}_i = \wedge_j NOT(R_{ij})$.

5.3 If it is in both sets, the following criteria are followed: a_i

A single value $V_i = (2 + R_{i1} - R_{i2} - R_{i3})/3$ is calculated, where $\bar{R}_i = \langle \bar{R}_{i1}, \bar{R}_{i2}, \bar{R}_{i3} \rangle$, while $F_i = (2 + R_{i1} - R_{i2} - R_{i3})/3$, where $\tilde{R}_i = \langle \tilde{R}_{i1}, \tilde{R}_{i2}, \tilde{R}_{i3} \rangle$.

5.3.1 If $\bar{V}_i > \bar{F}_i$ then the i-th statement is relevant with a truth value of \bar{R}_i .

5.3.2 If $\bar{V}_i < \bar{F}_i$ then the i-th test is not relevant with a value of truth \tilde{R}_i .

5.3.4 If $\bar{V}_i = \bar{F}_i$ then it is determined that the i-th test is not relevant enough with a truth value of $\bar{R}_i = \langle \bar{R}_{i1}, \bar{R}_{i2}, \bar{R}_{i3} \rangle$.

6. The statements that were classified as relevant are issued, sorted from highest to lowest, where $e_m > e_n$ if and only if $\bar{V}_m > \bar{V}_n$.

3 Application

To identify the main problems in relation to compliance with the legal framework that supports food sovereignty policies in Ecuador and its influence on its scope, interviews were applied to 25 jurists from the canton of Santo Domingo, province Santo Domingo de Los Tsáchilas. To carry out the study, 5 experts on the subject were chosen, who obtained K scores between 8 and 10, which is considered high.

An interview guide was designed as shown below:

Taking into account what you know about food sovereignty, analyze the following statements and issue a score concerning their veracity, in triads of values from 0 to 100, where the first value represents the veracity of the statement, the second the indeterminacy, and the last denial.

1. There is a need to guarantee vulnerable groups the right to healthy food.
2. Insufficient legal framework to guarantee the right to food sovereignty of Ecuadorians, in correspondence with international pronouncements and the Constitution of the nation.
3. Intermediaries are the main ones responsible for price inflation
4. Few resource allocations to peasant producers in order to increase food production in the area.

The 5 experts consulted (e_1, e_2, e_3, e_4, e_5) issue their criteria regarding the statements (a_1, a_2, a_3, a_4), in triads of values from 0 to 100, to standardize truthfulness, negative and indeterminate responses, where the first score represents the certainty or relevance of the statement, the second value indicates doubt or indeterminacy regarding the statement described and the third value indicates the falsehood of that statement. This algorithm will be applied twice to determine the veracity and the degree of relevance. [16, 24, 25, 26]

Application to determine the veracity of statements.

The results regarding veracity are shown in Table 1.

| Expert/Assertion | a_1 | a_2 | a_3 | a_4 |
|------------------|------------|------------|------------|------------|
| e_1 | (64,15,21) | (89,10,10) | (35,10,60) | (56,10,13) |
| e_2 | (76,10,20) | (58,20,30) | (38,0,52) | (72,8,20) |
| e_3 | (85,0,20) | (79,0,20) | (36,0,45) | (82,12,15) |
| e_4 | (68,4,18) | (72,15,18) | (45,0,58) | (54,15,22) |
| e_5 | (81,8,16) | (90,12,26) | (42,0,36) | (57,9,18) |

Table 1: Result of the evaluation of the veracity of the statement according to the selected experts.

The above results are divided by 100 to bring them to a [0, 1] scale which is more common in neutrosophic theories.

| Expert/Assertion | a_1 | a_2 | a_3 | a_4 |
|------------------|------------------|-----------------|----------------|------------------|
| e_1 | (0.64,0.15,0.21) | (0.89,0.1,0.1) | (0.35,0.1,0.6) | (0.56,0.1,0.13) |
| e_2 | (0.76,0.1,0.2) | (0.58,0.2,0.3) | (0.38,0,0.52) | (0.72,0.08,0.2) |
| e_3 | (0.85,0,0.2) | (0.79,0,0.2) | (0.36,0,0.45) | (0.82,0.12,0.15) |
| e_4 | (0.68,0.04,0.18) | (0.72,0.2,0.18) | (0.45,0,0.58) | (0.54,0.15,0.22) |
| e_5 | (0.81,0.08,0.16) | (0.9,0.1,0.26) | (0.42,0,0.36) | (0.57,0.09,0.18) |

Table 2: Result of the evaluation of the veracity of the statement according to the experts, expressed in the form of neutrosophic numbers.

Soft sets are defined as:

$$F(\text{yes}) = \left\{ \begin{aligned} &(e_1, a_1, (0.64,0.15,0.21)), (e_1, a_2, (0.89,0.1,0.1)), (e_1, a_3, (0.35,0.1,0.6)), (e_1, a_4, (0.56,0.1,0.13)), \\ &(e_2, a_1, (0.76,0.1,0.2)), (e_2, a_2, (0.58,0.2,0.3)), (e_2, a_3, (0.38,0,0.52)), \\ &(e_2, a_4, (0.72,0.08,0.2)), (e_3, a_1, (0.85,0,0.2)), (e_3, a_2, (0.79,0,0.2)), \\ &(e_3, a_3, (0.36,0,0.45)), (e_3, a_4, (0.82,0.12,0.15)), (e_4, a_1, (0.68,0.04,0.18)), \\ &(e_4, a_2, (0.72,0.2,0.18)), (e_4, a_3, (0.45,0,0.58)), (e_4, a_4, (0.54,0.15,0.22)) \\ &(e_5, a_1, (0.81,0.08,0.16)), (e_5, a_2, (0.9,0.1,0.26)), (e_5, a_3, (0.42,0,0.36)), (e_5, a_4, (0.57,0.09,0.18)) \end{aligned} \right\}$$

$$F(\text{no}) = \left\{ \begin{aligned} &(e_1, a_1, (0.64,0.15,0.21)), (e_1, a_2, (0.89,0.1,0.1)), (e_1, a_3, (0.35,0.1,0.6)), (e_1, a_4, (0.56,0.1,0.13)), \\ &(e_2, a_1, (0.76,0.1,0.2)), (e_2, a_2, (0.58,0.2,0.3)), (e_2, a_3, (0.38,0,0.52)), \\ &(e_2, a_4, (0.72,0.08,0.2)), (e_3, a_1, (0.85,0,0.2)), (e_3, a_2, (0.79,0,0.2)), \\ &(e_3, a_3, (0.36,0,0.45)), (e_3, a_4, (0.82,0.12,0.15)), (e_4, a_1, (0.68,0.04,0.18)), \\ &(e_4, a_2, (0.72,0.2,0.18)), (e_4, a_3, (0.45,0,0.58)), (e_4, a_4, (0.54,0.15,0.22)) \\ &(e_5, a_1, (0.81,0.08,0.16)), (e_5, a_2, (0.9,0.1,0.26)), (e_5, a_3, (0.42,0,0.36)), (e_5, a_4, (0.57,0.09,0.18)) \end{aligned} \right\}$$

$$G(\text{yes}) = \{(a_1, (0.64,0.15,0.21)), (a_2, (0.58,0.20,0.30)), (a_3, (0.35,0.10,0.60)), (a_4, (0.54,0.15,0.22))\}$$

$$G(\text{no}) = \{(a_1, (0.21,0.15,0.64)), (a_2, (0.30,0.20,0.58)), (a_3, (0.60,0.10,0.35)), (a_4, (0.22,0.15,0.54))\}$$

From $G(\text{yes})$ and $G(\text{no})$ it is concluded that a_1 is true with a truth value of (0.64,0.15,0.21), a_2 is true with a truth value of (0.58,0.20,0.30), the applied model yields that a_3 is not true, with a denial value of (0.60,0.10,0.35) of and finally a_4 is also true with a truth value of (0.22,0.15,0.54).

This decision is made since, $\bar{V}_1 = 0.8 > \bar{F}_1 = 0.5$; $\bar{V}_2 = 0.7 > \bar{F}_2 = 0.5$; $\bar{V}_3 = 0.6 < \bar{F}_3 = 0.7$; $\bar{V}_4 = 0.7 > \bar{F}_4 = 0.5$.

From the above, it is inferred that the statements a_1, a_2 and a_4 are true, while statement 3 is not.

Therefore, the relevance of the 3 statements that were identified as true by the experts will be analyzed:

1. There is a need to guarantee vulnerable groups the right to healthy food.
2. Insufficient legal framework to guarantee the right to food sovereignty of Ecuadorians, in correspondence with international pronouncements and the Constitution of the nation.
4. Few resource allocations to peasant producers in order to increase food production in the area.

Application to determine the relevance of claims.

The results regarding relevance are shown in Table 3.

| Expert/Assertion | a ₁ | a ₂ | a ₄ |
|------------------|----------------------------|----------------------------|----------------------------|
| e ₁ | $\langle 84,10,12 \rangle$ | $\langle 56,13,15 \rangle$ | $\langle 68,24,16 \rangle$ |
| e ₂ | $\langle 72,12,20 \rangle$ | $\langle 60,11,17 \rangle$ | $\langle 76,10,19 \rangle$ |
| e ₃ | $\langle 87,6,18 \rangle$ | $\langle 61,15,10 \rangle$ | $\langle 72,3,15 \rangle$ |
| e ₄ | $\langle 85,10,16 \rangle$ | $\langle 57,12,16 \rangle$ | $\langle 70,23,21 \rangle$ |
| e ₅ | $\langle 77,9,19 \rangle$ | $\langle 55,22,25 \rangle$ | $\langle 69,12,18 \rangle$ |

Table 3: Result of the evaluation of the relevance of the statements according to the experts.

The above results are divided by 100 to bring them to a [0, 1] scale which is more common in neutrosophic theories.

| Expert/Assertion | a ₁ | a ₂ | a ₄ |
|------------------|----------------------------------|----------------------------------|----------------------------------|
| e ₁ | $\langle 0.84,0.10,0.12 \rangle$ | $\langle 0.56,0.13,0.15 \rangle$ | $\langle 0.68,0.24,0.16 \rangle$ |
| e ₂ | $\langle 0.72,0.12,0.20 \rangle$ | $\langle 0.60,0.11,0.17 \rangle$ | $\langle 0.76,0.10,0.19 \rangle$ |
| e ₃ | $\langle 0.87,0.06,0.18 \rangle$ | $\langle 0.61,0.15,0.10 \rangle$ | $\langle 0.72,0.03,0.15 \rangle$ |
| e ₄ | $\langle 0.85,0.10,0.16 \rangle$ | $\langle 0.57,0.12,0.16 \rangle$ | $\langle 0.70,0.23,0.21 \rangle$ |
| e ₅ | $\langle 0.77,0.09,0.19 \rangle$ | $\langle 0.55,0.22,0.25 \rangle$ | $\langle 0.69,0.12,0.18 \rangle$ |

Table 4: Result of the evaluation of the relevance of the statements according to the experts, expressed in the form of neutrosophic numbers.

Soft sets are defined as:

$$F(\text{yes}) = \left\{ \begin{array}{l} (e_1, a_1, \langle 0.84,0.10,0.12 \rangle), (e_1, a_2, \langle 0.56,0.13,0.15 \rangle), (e_1, a_4, \langle 0.68,0.24,0.16 \rangle), \\ (e_2, a_1, \langle 0.72,0.12,0.20 \rangle), (e_2, a_2, \langle 0.60,0.11,0.17 \rangle),, \\ (e_2, a_4, \langle 0.76,0.10,0.19 \rangle), (e_3, a_1, \langle 0.87,0.06,0.18 \rangle), (e_3, a_2, \langle 0.61,0.15,0.10 \rangle), \\ (e_3, a_4, \langle 0.72,0.03,0.15 \rangle), (e_4, a_1, \langle 0.85,0.10,0.16 \rangle), \\ (e_4, a_2, \langle 0.57,0.12,0.16 \rangle), (e_4, a_4, \langle 0.70,0.23,0.21 \rangle) \\ (e_5, a_1, \langle 0.77,0.09,0.19 \rangle), (e_5, a_2, \langle 0.55,0.22,0.25 \rangle), (e_5, a_4, \langle 0.69,0.12,0.18 \rangle) \end{array} \right\}$$

$$F(\text{No}) = \left\{ \begin{array}{l} (e_1, a_1, \langle 0.84,0.10,0.12 \rangle), (e_1, a_2, \langle 0.56,0.13,0.15 \rangle), (e_1, a_4, \langle 0.68,0.24,0.16 \rangle), \\ (e_2, a_1, \langle 0.72,0.12,0.20 \rangle), (e_2, a_2, \langle 0.60,0.11,0.17 \rangle),, \\ (e_2, a_4, \langle 0.76,0.10,0.19 \rangle), (e_3, a_1, \langle 0.87,0.06,0.18 \rangle), (e_3, a_2, \langle 0.61,0.15,0.10 \rangle), \\ (e_3, a_4, \langle 0.72,0.03,0.15 \rangle), (e_4, a_1, \langle 0.85,0.10,0.16 \rangle), \\ (e_4, a_2, \langle 0.57,0.12,0.16 \rangle), (e_4, a_4, \langle 0.70,0.23,0.21 \rangle) \\ (e_5, a_1, \langle 0.77,0.09,0.19 \rangle), (e_5, a_2, \langle 0.55,0.22,0.25 \rangle), (e_5, a_4, \langle 0.69,0.12,0.18 \rangle) \end{array} \right\}$$

$$G(\text{yes}) = \{(a_1, \langle 0.72,0.12,0.20 \rangle), (a_2, \langle 0.55,0.22,0.25 \rangle), (a_3, \langle 0.68,0.24,0.16 \rangle)\}$$

$$G(\text{no}) = \{(a_1, \langle 0.20,0.12,0.72 \rangle), (a_2, \langle 0.25,0.22,0.55 \rangle), (a_3, \langle 0.16,0.24,0.68 \rangle)\}$$

From $G(\text{yes})$ and $G(\text{no})$ it is concluded that a_1 is relevant with a truth value of $\langle 0.72,0.12,0.20 \rangle$, a_2 is relevant with a truth value of $\langle 0.55,0.22,0.25 \rangle$, and finally, a_3 is also relevant with a truth value of $\langle 0.16,0.24,0.68 \rangle$.

This decision is made since, $\bar{V}_1 = 0.80 > \bar{F}_1 = 0.45$; $\bar{V}_2 = 0.69 > \bar{F}_2 = 0.49$; $\bar{V}_3 = 0.76 > \bar{F}_3 = 0.41$.

The order of relevance of the statements described is as follows: $a_1 > a_3 > a_2$, where all are relevant or important according to the results obtained.

Finally, the order of relevance of the statements described is as follows:

1. a_1 : There is a need to guarantee vulnerable groups the right to healthy food.

2. a_4 : Few resource allocations to peasant producers in order to increase food production in the area.
3. a_2 : Insufficient legal framework that guarantees the right to food sovereignty of Ecuadorians, in correspondence with international pronouncements and the Constitution of the nation.

Conclusions

The processing of the information through a Neutrosophic Soft Set model allowed knowing which of the statements analyzed were true and which should be left out of the study. In this way, one of the statements analyzed was discarded and the rest were prioritized, leaving in the first place the need to guarantee vulnerable groups the right to healthy food, in second place, the fact that resource allocations to peasant producers are scarce in order to increase food production in the area and lastly the insufficient legal framework that guarantees the right to food sovereignty of Ecuadorians, in correspondence with international pronouncements and the Constitution of the nation.

References

- [1] O. V. Cordero-Ahiman. (2022) Ley Orgánica del Régimen de la Soberanía Alimentaria de Ecuador. *Revista chilena de nutrición*. 34-38.
- [2] M. Tilzey, "Capitalism, imperialism, nationalism: agrarian dynamics and resistance as radical food sovereignty," *Canadian Journal of Development Studies/Revue canadienne d'études du développement*, vol. 41, no. 3, pp. 381-398, 2020.
- [3] I. Giunta and J. D. González, "Crecimiento económico inclusivo y sostenible en la Agenda 2030: un análisis crítico desde la perspectiva de la soberanía alimentaria y los derechos de la naturaleza," *Revista Iberoamericana de Estudios de Desarrollo= Iberoamerican Journal of Development Studies*, vol. 9, no. 1, pp. 146-176, 2020.
- [4] A. Vergara-Romero, A. Menor Campos, O. Arencibia Montero, and J. A. Jimber del Río. (2022) Soberanía alimentaria en Ecuador: descripción y análisis bibliométrico. *Revista Venezolana de Gerencia*. 498-510.
- [5] R. Merino, "The Geopolitics of Food Security and Food Sovereignty in Latin America: Harmonizing Competing Visions or Reinforcing Extractive Agriculture?," *Geopolitics*, vol. 27, no. 3, pp. 898-920, 2022.
- [6] M. Khan, L. H. Son, M. Ali, H. T. M. Chau, N. T. N. Na, and F. Smarandache, "Systematic review of decision making algorithms in extended neutrosophic sets," *Symmetry*, vol. 10, no. 8, p. 314, 2018.
- [7] D. Molodtsov, "Soft set theory—first results," *Computers & mathematics with applications*, vol. 37, no. 4-5, pp. 19-31, 1999.
- [8] M. Abu Qamar and N. Hassan, "An approach toward a Q-neutrosophic soft set and its application in decision making," *Symmetry*, vol. 11, no. 2, p. 139, 2019.
- [9] N. El-Hefenawy, M. A. Metwally, Z. M. Ahmed, and I. M. El-Henawy, "A review on the applications of neutrosophic sets," *Journal of Computational and Theoretical Nanoscience*, vol. 13, no. 1, pp. 936-944, 2016.
- [10] I. Deli, "Interval-valued neutrosophic soft sets and its decision making," *International Journal of Machine Learning and Cybernetics*, vol. 8, no. 2, pp. 665-676, 2017.
- [11] M. I. Ali, F. Feng, X. Liu, W. K. Min, and M. Shabir, "On some new operations in soft set theory," *Computers & Mathematics with Applications*, vol. 57, no. 9, pp. 1547-1553, 2009.
- [12] S. Mauksch, A. Heiko, and T. J. Gordon, "Who is an expert for foresight? A review of identification methods," *Technological Forecasting and Social Change*, vol. 154, p. 119982, 2020.
- [13] F. Smarandache, "Introduction to the IndetermSoft Set and IndetermHyperSoft Set," *Neutrosophic Sets and Systems*, vol. 50, no. 1, p. 38, 2022.
- [14] F. G. Naranjo Armijo, L. H. Carrión Hurtado, & F. G. Bosmediano Andrade. "Gestión administrativa en las pymes del sector comercial en la ciudad de Santo Domingo en Ecuador". *Universidad y Sociedad*, vol. 14 no.3, pp 504-513, 2022.
- [15] B. R. Pinda Guanolema. "Análisis de aporte a reactivación económica pot-covid-19 del sector agropecuario en provincia de Chimborazo, Ecuador". *Universidad y Sociedad*, vol. 14 no.3, pp 493-503, 2022.
- [16] W. V. Culque Toapanta, J. D. R. Gavilanes Palacios, A. M. Tiban Chito, & L. A. De la Torre. "Aplicación web-móvil para la gestión de productores agropecuarios del gobierno autónomo descentralizado del cantón mocha". *Universidad y Sociedad*, vol. 14 no.3, pp 487-492, 2022.
- [17] Romero Fernández, A. J., Álvarez Gómez, G. A., & Estupiñán Ricardo, J. "La investigación científica en la educación superior como contribución al modelo educativo". *Universidad Y Sociedad*, vol. 13 no. S3, pp 408-415, 2021.
- [18] González, I. A., Fernández, A. J. R., & Ricardo, J. E. "Violación del derecho a la salud: caso Albán Comejo Vs Ecuador". *Universidad Y Sociedad*, vol. 13 no. S2, pp 60-65, 2021.

- [19] Vera, D. C., Suntaxi, A. V. T., Alcívar, G. C. I., Ricardo, J. E., & Rodríguez, M. D. O. “Políticas de inclusión social y el sistema de ingreso a las instituciones de educación superior del Ecuador”. *Dilemas Contemporáneos: Educación, Política y Valores*. Vol. 1 no. 19, pp 1-18, 2018.
- [20] Leyva Vázquez, M. Y., Estupiñán Ricardo, J., Coles Gaglay, W. S., & Bajaña Bustamante, L. J. “Investigación científica. Pertinencia en la educación superior del siglo XXI”. *Conrado*, vol. 17 no. 82, 2021.
- [21] Ricardo, J. E. (2018). “Estrategia de Gestión en la Educación Superior; pertinencia e impacto en la interrelación de los procesos académicos, de investigación científica y de vinculación con la sociedad en el periodo enero 2016-mayo 2018 en la Facultad de Ciencias Jurídicas, Sociales y de la Educación de la Universidad Técnica de Babahoyo en Ecuador”. *Infinite Study*, 2018.
- [22] Estupiñán Ricardo, J., Martínez Vásquez, Á. B., Acosta Herrera, R. A., Villacrés Álvarez, A. E., Escobar Jara, J. I., & Batista Hernández, N. “Sistema de Gestión de la Educación Superior en Ecuador. Impacto en el Proceso de Aprendizaje”. *Dilemas Contemporáneos: Educación, Política y Valores*, 2018.
- [23] von Feigenblatt, O. F. “Education, culture, and underdevelopment: Haiti’s tragic failure”. *Universidad y Sociedad*, vol. 14 no. 3, pp 604-611, 2022.
- [24] K. E. Carrión León, M. A. Torres Villamarín, J. C. Arandia Zambrano & E. E. Pino Andrade. “Los derechos laborales de la clase obrera al someterlos a las regulaciones de la LOSEP en Ecuador”. *Universidad y Sociedad*, vol. 14 no. S4, pp 350-358, 2022.
- [25] G. N. Solis Ana Luisa, J. R. Santillán Andrade, P. A. Centeno Maldonado & R. E. Chuga Quemac. “El trabajo infantil frente al interés superior del niño. Caso de estudio Ecuador”. *Universidad y Sociedad*, vol. 14 no. S4, pp 342-349, 2022.
- [26] I. E. Albuja Lalangui, L. V. Rosillo Abarca, L. R. Ayala Ayala & I. F. Barcos Arias. “Estudio de la violencia intrafamiliar psicológica contra el hombre en el cantón de Santo Domingo, Ecuador”. *Universidad y Sociedad*, vol. 14 no. S4, pp 333-341, 2022.

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