Presumption of Innocence: Analysis of its Application using Neutrosophic Methods

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Abstract

The application of the principle of innocence in Ecuador has irregularities since there has been an abuse of preventive detention, violating the constitutional and normative principle of the presumption of innocence. The justification for the preventive detention lies in the alleged need to ensure the accused's appearance. This turns this form of insurance into an early conviction because by proving his innocence at the hearing,the accused has already been unjustly deprived of his freedom, which leads him to suffer another series of damages. Therefore, it is necessary to study the subject to determine how to achieve its proper application. Thus, the main objective of this research is to analyze the legal panorama on the adequate application of the principle of innocence. For this, the neutrosophic Iadov method was applied to measure satisfaction with the regulatory legislation to determine an action plan for its correct application with the use of neutrosophic cognitive maps.

Keywords: neutrosophic Iadov; principle of innocence; neutrosophic cognitive maps

1. Introduction

The principle of innocence becomes the maximum guarantee that a person who is the subject of a process has. "Every man must be presumed innocent as long as he is not found guilty, if it is deemed essential to arrest him, all rigor that is not necessary to ensure his person, must be severely repressed by law (p. 2). This means that the accused must be treated as innocent as long as there is no conviction against him [1]. This principle is a right that every Ecuadorian citizen possesses and is explicit in the Constitution of the Republic. It is an essential part of due process and dictates treatment to a defendant until proven guilty[2, 3].

In the Integral Organic Criminal Code of Ecuador that came into force in 2014, it guarantees in article 5, paragraph 4 that: "everyone maintains their legal status of innocence and must be treated as such, as long as a sentence that determines otherwise is not executed" [4]. Similarly, it is legislated in the Magna Carta of 2008, in its article 76, numeral 2, it details that: "the innocence of every person will be presumed, and they will be treated as such, as long as their responsibility is not declared by a resolution or final judgment" [2, 5].

On the other hand, its imposition is contrary to international human rights instruments and the law that states, in any legal system, that everyone is innocent until proven otherwise, and therefore, the imposition of such a measure is not viable. The justification for the preventive detention lies in the alleged need to ensure the accused's appearance. Which turns this form of assurance into an early conviction, because by proving his innocence at the hearing, the accused has already been unfairly deprived of his freedom, which leads him to suffer another series of damages, such as:

➢ job loss, family hardship,

➢ loss of a good reputation,

➢ psychological affectation.

Then, the problem is: how to achieve the adequate application of the principle of presumption of innocence to guarantee the principles of due process? Therefore, it is established as the main objective: to analyze the legal panorama on the adequate application of the principle of innocence. The following are then established as specific objectives:

a. Determine the satisfaction with the legislation that regulates the principle of innocence through the Iadov method in its neutrosophic extension.

b. Determine an action plan for its correct application

- Propose strategies

- Determine an order for its implementation by applying neutrosophic cognitive maps.

After reviewing the bibliography and the consultation of several authors, it was decided that, due to its versatility in investigating factors, two tools would be used: the Iadov method and neutrosophic cognitive maps from the theory of neutrosophy proposed by Florentin. Smarandache, for the treatment of neutralities. Neutrosophy is a useful theory that increases the inclusion of this theory and enriches the possibilities of analysis, mainly due to two issues: the addition of the notion of indeterminacy and, secondly, the possibility of calculating using linguistic terms [6-12]. The investigation will consist of sections explaining the methods and techniques to obtain and process information, the presentation of the case study, the results obtained, and their discussion. Thus, ending with the conclusions.

2. Methods and techniques

2.1 Theoretical methods

To fulfill the specific objectives proposed, it was necessary to apply the following theoretical methods:

- Analysis and Synthesis of the information obtained from the literature review, both international and national, of specialized documentation, as well as the experience of observers and actors consulted to develop logical and valid conclusions, as well as a set of premises and/ or positions

- Systemic - structural for the development of the analysis through its decomposition into the elements that comprise it.

1.2 Practical methods

Interviews: it will be applied to the sample made up of the target population and selected experts. Structured interviews were prepared to obtain information about the real problem and possible solutions, obtain valid conclusions, and support the results. In this work, a focus group or focal group is carried out, considered by some researchers as group interviews, consisting of meetings with small or

medium groups (from 3 to 10 people), in which the people who interact talk about one or various topics in a relaxed and informal setting, under the guidance of a group dynamics specialist.

2.3 Neutrosophic Cognitive Maps

Starting from the previous elements, in this particular work, the use of Neutrosophic Cognitive Maps (NCMs) is proposed considering the advantages that this technique offers compared to other soft-computing techniques in terms of interpretability, scalability, aggregation of knowledge, dynamism, and its ability to represent feedback and indeterminacy relationships. NCMs were introduced by [13-15] in 2003. NCMs are an integration of the Fuzzy Cognitive Maps (FCMs) introduced by Kosko in 1986 and the Neutrosophic Sets (NSs) introduced by Smarandache in 1995 [16]. This technique overcomes the inability of traditional FCMs to represent indeterminacy. The inclusion of indeterminacy establishes that neutrality and ignorance are also forms of uncertainty [17]. Exposes that FCMs constitute a technique that has received increasing attention due to its possibilities for representing causality. The following is a set of definitions necessary for working with NCMs. First, let's formally expose the original definition of neutrosophic logic as shown in [18].

Definition 1. Let $N = \{(T,I,F): T,I,F \in [0,1]\}$be a *neutrosophic set of evaluations*. v: $P{\rightarrow}$N is a mapping of a group of propositional formulas into N, ie, each sentence p$\in$ is associated to a value in N, as it is exposed in Equation 1, meaning that p is T% true, I% indeterminate, and F% false.

$$v\,(p) \;=\; (T,I,F) \tag{1}$$

Hence, the neutrosophic logic is a generalization of fuzzy logic based on the concept of neutrosophy according to [13, 19].

Definition 2. (See [17, 18]) Let K be the ring of real numbers. The ring generated by K$\cup$I is called a neutrosophic ring if it involves the indeterminacy factor in it, where I satisfies I2 = I, I + I = 2I and in general, I + I + ... + I = nI, if k$\in$, then kI = kI, 0I = 0. The neutrosophic ring is denoted by K (I), which is generated by K$\cup$I, ie, K (I) = <K$\cup$I>, where <K$\cup$I> denotes the ring generated by K and I.

Definition 3. A neutrosophic matrix is a matrix A = $[a_{ij}]_{ij}$ i = 1, 2,…, m and j = 1, 2,…, n; m, n$\geq$1, such that each aij$\in$K (I), where K (I) is a neutrosophic ring, see [20].

Let us observe that an element of the matrix can have the form a + bI, where "a" and "b" are real numbers, whereas I is the indeterminacy factor. Then, the usual operations of neutrosophic matrices can be extended from the classical matrix operations.

For example, $\begin{pmatrix} -1 & I & 5I \\ I & 4 & 7 \end{pmatrix}\begin{pmatrix} I & 9I & 6 \\ 0 & I & 0 \\ -4 & 7 & 5 \end{pmatrix} = \begin{pmatrix} -21I & 27I & -6+25I \\ -28+I & 49+13I & 35+6I \end{pmatrix}$

Additionally, a *neutrosophic graph* is a graph that has at least one indeterminate edge or one indeterminate node. The *neutrosophic adjacency matrix* extends the adjacency matrix in classical graph theory. a_{ij} = 0 means nodes i and j are not connected, a_{ij} = 1 means that these nodes are connected and a_{ij} = I, which means the connection is indeterminate (unknown if it is or if not). Fuzzy set theory does not use such notions. On the other hand, if the indetermination is introduced in a cognitive map as referred to in [21], this cognitive map is called a neutrosophic cognitive map, which is especially useful in representing causal knowledge. It is formally defined in Definition 4.

Definition 4. A *Neutrosophic Cognitive Map* (NCM) is a neutrosophic directed graph with concepts like policies, events, among others, as nodes and causalities or indeterminates as edges. It represents the causal relationship between concepts.The measures described below are used in the proposed model, they are based on the absolute values of the adjacency matrix [21]:

- Outdegree (vi) is the sum of the row elements in the neutrosophic adjacency matrix. It reflects the strength of the outgoing relationships (cij) of the variable:

$$od(v_i) = \sum_{i=1}^{n} c_{ij} \tag{2}$$

- Indegree (v_i) is the sum of the column elements. It reflects the strength of relations (cij) outgoing from the variable.

$$id(v_i) = \sum_{i=1}^{n} c_{ji} \tag{3}$$

- Total centrality (total degree td (vi)), is the sum of the indegree and the outdegree of the variable.

$$td(v_i) = od(v_i) + id(v_i) \tag{4}$$

The variables are classified according to the following criteria:

   a. The *transmitting variables* are those with od (vj)> 0 and id (vi) = 0.

   b. The *receiving variables* are those with od (vj) = 0 and id (vi)> 0.

   c. *Ordinary variables* satisfy both od (vj) ≠ 0 and id (vi) ≠ 0.

The static analysis is applied using the adjacency matrix, considering the absolute value of the weights. Static analysis in Neutrosophic Cognitive Maps (NCM), see [22], initially contains the neutrosophic number of the form (a + bI), where I = indetermination Then, irequires a process of de-neutrosophication as proposed in [21], where I ∈[0, 1] and it is replaced by their values maximum and minimum. Finally, we work with the average of the extreme values, which is useful for obtaining a single value. This value contributes to identifying the characteristics to be attended, according to the factors obtained, for our case study.

$$\lambda([a_1, a_2]) = \frac{a_1 + a_2}{2} \tag{5}$$

Then,

$$A \succ B \Leftrightarrow \frac{a_1 + a_2}{2} > \frac{b_1 + b_2}{2} \tag{6}$$

2.4 Neutrosophic IADOV

The technique in its original version was created to study satisfaction with the profession in pedagogical students [23]. This technique was used to assess satisfaction with the profession in professional pedagogical training and the methodology for its use in [24]. The technique consists of five questions: three closed and 2 open. It constitutes an indirect way to study satisfaction since the criteria used are based on the relationships established between three closed questions that are inserted within a questionnaire whose relationship the subject is unaware of.

These three questions are related through the "Iadov Logical Chart." The unrelated or complementary questions serve as an introduction and objective support to the respondent who uses them to locate and contrast the answers. The number resulting from the three questions' interrelation indicates each subject's position on the satisfaction scale [6, 8, 9, 11].

For this case, the determination of the actors' appreciation of the impact of the strategy constitutes a significant indicator of the strategy's validity. Therefore, this action needs to validate the investigation results and for that purpose, the Iadov technique is applied, which constitutes an indirect way to determine the level of satisfaction, in this case, users of the strategy.

This technique uses, as the original method proposes, the related criteria of responses to interleaved questions whose relationship the subject is unaware of, at the same time the unrelated or complementary questions serve as introduction and objectivity support to the respondent who uses them to locate and contrast the answers. Furthermore, the inclusion of Neutrosophics allows for handling the indeterminacy in the answers. As the result of this work, the satisfaction of emitting actors and those who are beneficiaries of the development strategy, the receiving actors, are combined.

The introduction of the Neutrosophic estimation seeks to solve the problems of indeterminacy that appear universally in the evaluations of surveys and other instruments, taking advantage of the opposite and opposite positions and the neutral or ambiguous ones. Starting from the fact that every idea <A> tends to be neutralized, diminished, in a clear break with the binary doctrines in explaining and understanding phenomena[25]. The scale used is represented as follows:

$$v(p) = (T, I, F) \tag{7}$$

To achieve the verification of the necessary elements in decision making, the neutrosophic single value sets were presented; to increase the quantitative analysis in the understanding in the models of suggestions to assess the indeterminacy.

Table 1: Satisfaction scale. Adapted from [26].

Expression	SVN number	Punctuation
Satisfied	(1, 0, 0)	1
More satisfied than dissatisfied	(1, 0.25, 0.25)	0.5
Neutral	I	0
More dissatisfied than Satisfied	(0.25, 0.25, 1)	-0.5
Totally satisfied	(0,0,1)	-1
Opposites	(1,0,1)	0

To sort alternatives a scoring function is used:

$$s(V) = T - F - I \tag{8}$$

In the case of undefined results, the neutrosophication process is used as proposed by [21]. In this case, it is replaced by its maximum and minimum values. Finally, the mean of the extreme values is used to obtain a single value. The results are then aggregated and the weighted average (WA) aggregation operator is used. WA is one of the most mentioned aggregation operators in the literature[27, 28]. A WA operator has associated a vector of weights V, with $v_i \in [0,1]$ and $\sum_1^n v_i = 1$, having the following form:

$$WA(a_1, \ldots, a_n) = \sum_1^n v_1 a_1 \tag{9}$$

Where v_i represents the importance/relevance of the data source a_i.

Table 2: IADOV Logic Chart [26]

Logical box	1st question		
	Yes	I don't know	No
	2nd question		
	Yes- IDK-No	Yes- IDK-No	Yes- IDK-No

3rd question									
I like very much	1	2	6	2	2	6	6	6	6
I like more than I dislike	2	3	3	2	3	3	6	3	6
It does not matter to me	3	3	3	3	3	3	3	3	3
I dislike it more than I like it	6	3	6	3	4	4	3	4	4
I do not like it	6	6	6	6	4	4	6	4	5
I don't know what to say	2	3	6	3	3	3	6	3	4

The group satisfaction index (GSI) is obtained using the following formula:

$$GSI = \frac{A(+1) + B(+0.5) + C(0) + D(-0.5) + E(-1)}{N} \tag{10}$$

Where: N is the total number of respondents, and the letters correspond to the number of respondents in the categories indicated in table 1.

The group satisfaction index can range from [-1; 1], divided into the following categories:

Figure 1: Satisfaction categories [26]

3. Results and discussion

3.1 Measurement of the level of satisfaction

The IADOV method was applied to diagnose the real situation regarding the legislation and its knowledge in two police units of the canton with a high level of crime incidence, with their main actors (lawyers, instructors, agents).

Questions applied to respondents:

1. How important is the application of the principle of innocence?
2. In your opinion, what aspect limits the application of the principle of innocence?
3. Do you know if applying the principle of innocence in all proceedings is appropriate?
4. Are you satisfied with the current legislation that regulates the principle of innocence?
5. Does your level of knowledge allow you to apply the principle of innocence under the law?

The results are described below:

Table 3: Summary of the assessments given by the interviewees

Satisfaction scale	SVNN	Police Unit 1	Police Unit 2
Clear satisfaction	(1, 0, 0)	7	1
More satisfied than dissatisfied	(1, 0.25, 0.25)	9	14
Undefined	I	5	15
More dissatisfied than satisfied	(0.25, 0.25, 1)	0	1
Clear dissatisfaction	(0,0,1)	3	0
Contradictory	(1,0,1)	0	0

n (for 95% confidence)	/////////////	24	31
ISG	///////////////	**0.35417**	**0.242**

The calculation of the score is performed and the calculation of Iadov is determined, in this case, each
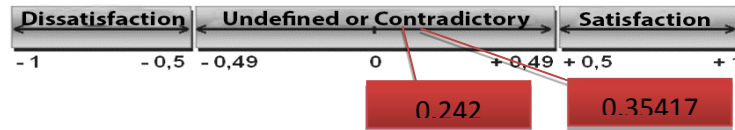
was assigned a weight vectorvalue of $w_1 = w_{23} = 0.048$.

Figure 2: Location of the result on the satisfaction scale.

As could be seen in both cases, the interviewed groups showed a low and contradictory level of satisfaction (<0.5). It could be seen that the principle of innocence is not applied correctly since there is a prejudice that a person is guilty from the beginning of the process, which results in inappropriate behavior towards the accused. In addition, it can be seen that the level of training on the subject is low, especially in those interviewed who do not have a higher level of experience in the units. Due to their experience in the field, they assume prejudices for the community in which they are located and the high level of crime in the area. It was also found that in the case of the defense attorneys interviewed, they refer to the need to increase regulatory legislation. Mainly in crimes related to traffic accidents where the understanding of the facts is diffuse. Commonly violating the provisions of the Constitution and Due Process, they must ensure compliance with the rights and obligations of any order, including the basic guarantees.

3.2 Action plan

To establish an action plan to mitigate this situation, it is decided to carry out a consultation process with the academy and experienced specialists to determine the strategies to follow. From the interviews carried out, the following actions could be contemplated:

a. Establish training actions starting at the base of the judicial system

b. Establish exchange processes between the main actors of the police units with the academy, mainly with the law degree

c. Carry out a personnel exchange program between police units (preferably those with the best and worst results in police and judicial management)

d. Create a supervision group by the Prosecutor's Office to the process where the preventive detention orders imposed are periodically reviewed.

e. Establish mechanisms of action where preventive detention is only issued by judges in serious crimes, which have a considerable social impact.

f. Prioritize the application of alternative and non-custodial mechanisms, offered by domestic legislation, to ensure the accused's presence in the procedure's conduct

The neutrosophic cognitive map method will be applied to establish an action order for planning and minimizing resources. The following is the processing:

$$
N(E) = \begin{bmatrix}
0 & 1 & 1 & 1 & 1 & 1 \\
1 & 0 & 1 & 1 & 0.4 & 0.9 \\
1 & 1 & 0 & 1 & 0.9 & 0 \\
I & I & 0.8 & 0 & 0.7 & I \\
I & 0.7 & 0.9 & 1 & 0 & 0 \\
I & 0.8 & 0.9 & 0.6 & 0 & 0
\end{bmatrix}
$$

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Figure 3: Adjacency matrix. Own elaboration

Table 3: Summary of the evaluations given by the interviewees. Souce: Own elaboration

Proposed solutions	*id*	*od*	*td*	Order
a	5	4	9	1
b	4.3	4	8.3	3
c	3.9	4.6	8.5	2
d	3	4.6	7.6	4
e	3.1	3	6.1	5
f	3.3	2.4	5.7	6

1.
•Establish training actions.

2.
•Carry out an exchange program.

3.
•Establish exchange processes between units and academia.

4.
•Create a monitoring group.

5.
•Establish mechanisms of action for preventive detention.

6.
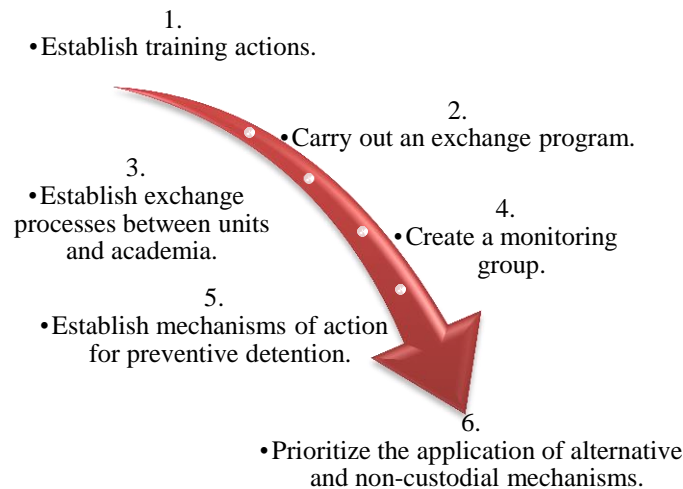•Prioritize the application of alternative and non-custodial mechanisms.

Figure 4: Order of activities for the solution. Source: Own elaboration

As shown in figure 4, a plan must be established that includes the order in an action plan. The academy, referring to the career of Law, must be a participant in the changes introduced to the process. It is necessary to link the university and society so that the feedback is more fruitful.

4. Conclusions

There are regulations for applying the principle of innocence in Ecuador. However, its application has presented difficulties since preventive detention is normally imposed in violation of the provisions.

The above was verified in two units surveyed using the neutrosophic Iadov technique during the study. In addition, the lack of training and knowledge on the subject could be verified as one of the main causes. Applying an interview and reviewing the bibliography, it was possible to obtain possible strategies to apply, which through a neutrosophic cognitive map, determined the order of application to establish an action plan.

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