

# NEUTROSOPHIC PROCEDURE FOR THE EVALUATION OF BALANCE OF RIGHTS IN ECUADOR

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## ABSTRACT.

The present study tackles a fundamental question: How effective and relevant is the balancing of rights in protecting vulnerable groups within the Ecuadorian legal framework when approached through neutrosophic methods? This research emerges in a setting where regulatory ambiguity and the complexity of rights balancing pose significant obstacles to safeguarding those most at risk. The importance of this inquiry is underscored by its direct impact on justice and social equity—critical issues that demand scrutiny. Despite extensive scholarship on legal rights and protections, there remains a notable void in integrating neutrosophic principles into jurisprudential and administrative analysis, a gap this study aims to bridge. To confront this challenge, a methodology rooted in neutrosophic procedures was employed, encompassing the analysis of jurisprudence, administrative decisions, and insights from interviews with constitutional law and human rights experts to uncover conflicting rights, arguments presented, and underlying decision-making rationales. The findings reveal that although rights weighting is applied across various scenarios, significant levels of indeterminacy and falsity linger in its execution, potentially hindering the effective protection of vulnerable populations. In response, the study advocates for a specific provision in the Organic Law of Jurisdictional Guarantees and Constitutional Control, proposing clear, objective criteria founded on neutrosophic principles to guide judicial decisions. Such an approach would facilitate the assessment of truth, falsity, and indeterminacy on a case-by-case basis, ensuring a fairer and more robust balancing of vulnerable groups' rights. Ultimately, this research not only advances theoretical understanding by introducing an innovative method into the discussion of rights balancing but also offers practical implications aimed at reinforcing protection measures for society's most vulnerable, thereby promoting their full respect and validity.

**KEYWORDS:** Neutrosophic procedure, Weighting of rights, Vulnerable groups, Protection, Jurisprudence, Ecuadorian legal system, Regulatory conflicts.

**MSC:** 03B70, 91D10, 68T37, 93C41, 62P25

## RESUMEN

El presente estudio aborda la cuestión fundamental de evaluar la eficacia y relevancia del equilibrio de derechos para la protección de grupos vulnerables dentro del marco legal ecuatoriano, utilizando un enfoque neutrosófico. Este problema de investigación surge en un contexto donde la falta de claridad regulatoria y la complejidad inherente al balance de derechos plantean desafíos significativos para salvaguardar a quienes más lo necesitan. La importancia de este tema radica en su impacto directo en la garantía de justicia y equidad social, factores críticos en la actualidad que demandan una investigación metódica. A pesar de la abundante literatura sobre derechos y protección legal, existe una notoria ausencia de estudios que integren principios neutrosóficos al análisis jurisprudencial y administrativo, lo cual constituye una brecha que esta investigación busca llenar. Para abordar este problema, se implementó una metodología basada en procedimientos neutrosóficos, analizando tanto la jurisprudencia y decisiones administrativas como entrevistas con expertos en derecho constitucional y derechos humanos, con el objetivo de identificar derechos conflictivos, argumentos presentados y razonamientos decisorios. Los resultados obtenidos revelan que, aunque el proceso de ponderación de derechos se aplica en diversos contextos, persisten altos niveles de indeterminación y falsedad en su implementación, lo que podría socavar la protección efectiva de los grupos vulnerables. A partir de este análisis, el estudio propone la incorporación de una disposición específica en la Ley Orgánica de Garantías Jurisdiccionales y Control Constitucional, estableciendo criterios claros y objetivos fundamentados en principios neutrosóficos para orientar a los jueces. Esta recomendación estratégica permitiría evaluar la verdad, la falsedad y la indeterminación en cada caso, garantizando un equilibrio más justo y robusto de los derechos de los grupos vulnerables. En consecuencia, la investigación no solo contribuye a enriquecer el conocimiento teórico sobre la ponderación de derechos con un enfoque innovador, sino que también ofrece implicaciones prácticas orientadas a fortalecer la protección de los sectores más desprotegidos y promover su pleno respeto y vigencia en la sociedad.

**PALABRAS CLAVE:** Procedimiento neutrosófico, Ponderación de derechos, Grupos vulnerables, Protección, Jurisprudencia, Sistema legal ecuatoriano, Conflictos normativos.

## 1. INTRODUCTION

The balancing of rights to protect vulnerable groups within legal frameworks has long been a subject of scholarly interest and social urgency. As societies evolve and face new challenges, ensuring that legal mechanisms adequately safeguard those at risk becomes paramount [17]. This study examines the efficacy and relevance of rights balancing through innovative neutrosophic methods, aiming to enhance the protection afforded to vulnerable populations. Such an investigation is significant given the ongoing debates in legal theory and human rights advocacy about how best to adapt existing systems to emerging complexities [18]. Historically, the interplay between legal rights and societal protection has shifted dramatically. In earlier eras, rights were often absolute, but modern legal systems have gradually

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recognized the need to balance conflicting interests for the common good [19,23]. Over time, key developments—such as the adoption of international human rights conventions and the evolution of constitutional jurisprudence—have shaped current practices of rights weighing. These changes underscore the necessity for more sophisticated analytical approaches to address persistent gaps and ambiguities in legal protection [20,24].

Despite substantial progress, the present context reveals a critical problem: How effective is the current process of balancing rights in truly safeguarding vulnerable groups within the Ecuadorian legal system? This research question emerges from observable deficiencies in legislative and judicial practices where conflicting rights and regulatory uncertainty hinder effective protection. The magnitude of this issue is profound, as inadequate balancing may leave vulnerable populations exposed to injustice and exploitation [21]. This study identifies that, although a variety of legal measures exist, significant challenges remain in applying them consistently and fairly, especially when ambiguous situations arise. The complexity inherent in balancing competing rights calls for innovative frameworks capable of navigating uncertainty. The focus on neutrosophic methods responds directly to this need, offering a structured way to handle ambiguity that traditional approaches may overlook [22]. To address the central question, the study employs a methodology rooted in neutrosophic procedures. This includes an analysis of jurisprudence and administrative decisions, supplemented by interviews with experts in constitutional law and human rights. These methods allow for a granular examination of how rights conflicts are resolved and what rationales guide those resolutions. The findings suggest that, despite the widespread application of rights weighing, notable degrees of indeterminacy and error remain. Such uncertainty may compromise the protection of vulnerable groups, indicating that current practices require refinement. These insights highlight the importance of developing clearer, more objective criteria for rights balancing, ensuring that the legal process is transparent and just.

Based on these results, the study advocates for incorporating a specific provision within the Organic Law of Jurisdictional Guarantees and Constitutional Control. This provision would establish neutrosophic-based criteria to guide judicial decisions, enabling judges to evaluate truth, falsity, and indeterminacy in each case more effectively. In doing so, the proposed changes aim to create a fairer, more consistent system for balancing rights that directly benefits vulnerable populations. Ultimately, the research not only advances theoretical understanding by introducing an innovative neutrosophic approach to rights balancing but also provides practical recommendations for legal reform. By addressing the inherent uncertainty and complexity in legal protections, the study lays the groundwork for more robust and equitable safeguard mechanisms, promoting justice and social equity for society's most vulnerable members.

## 2 PRELIMINARY

Decision-making is characterized as a procedure by which different options are chosen, based on a group of criteria, to achieve one or more objectives [5,25], [6], [7]. According to Schein, decision-making involves “recognizing a challenge or occasion and selecting a choice among different available options”, representing an essential activity in all organizational structures. [8], [9], [10], [11].

When the decision process involves the evaluation of multiple criteria and alternatives, it is considered a multi-criteria decision drawback [12-14]. In this context, multi-criteria evaluation consists of the simultaneous optimization of several objective functions with the participation of a decision agent. Equation 1 formalizes this drawback.

$$\text{Max} = F_x \quad x \in X \quad (1)$$

$X$ : is the so-called vital region. It represents the possible range of values that the variable can take.

$\text{Max}$ : represents the function to be maximized, this is not limiting.

Discrete multicriteria problems are generally composed of two types of data that serve as a starting point for several discrete multicriteria decision problems (DMD).

First, there are the evaluation criteria, which are the various aspects or dimensions that must be considered when making a decision. These criteria may vary depending on the context of the problem and the preferences of the decision-maker. For example, in the business environment, criteria can cover cost, quality, and availability, among others.

Secondly, there are decision alternatives, that is, the different options between which one must choose. These alternatives represent the possible actions that the decision-maker can take to resolve the problem in question. For example, in a supplier selection context, the alternatives may be several supplier companies that offer the necessary products or services.

These two types of data, evaluation criteria and decision alternatives provide the initial framework for addressing discrete decision problems with multiple criteria. From this data, specific models and techniques are developed to help the decision maker systematically evaluate and compare alternatives and make an optimal or satisfactory decision.

Each decision problem may present its particularities, but given the versatility inherent in its nature, it is possible to define a general procedure to address its resolution. The following diagram shows a diagram that illustrates this procedure for solving decision problems.

The process begins with the identification and clear definition of the problem in question. It is essential to fully understand the nature of the problem and the objectives that must be achieved through the decision-making process.

Once the problem has been defined, relevant information is collected. This involves gathering data on evaluation criteria, available alternatives, and any other relevant information that may influence the decision-making process. After collecting the information, the alternatives are evaluated and analyzed. This involves applying evaluation criteria to evaluate each alternative based on its performance against the objectives and requirements of the problem. Once the evaluation is completed, the alternatives are compared and the best option is selected. This step involves considering the strengths and weaknesses of each alternative, as well as the trade-offs that may arise when choosing one option over another.

Finally, the selected decision is implemented and its execution is monitored to ensure that the desired results are achieved. It is important to be prepared to make changes if necessary during the implementation of the action plan. This decision-making problem-solving scheme provides a general framework that can be adapted to different problems, allowing for a systematic and structured approach to problem-solving in various situations.

1. Identification of the problem:
  - Clearly define the problem or situation that requires a decision.
  - Identify the objectives that must be achieved through the decision-making process.
2. Information collection:
  - Collect relevant data about the problem, evaluation criteria and available alternatives.
  - Analyze qualitative and quantitative information to have a complete understanding of the problem.
3. Analysis of alternatives:
  - Evaluate each alternative based on the established evaluation criteria.
  - Compare the strengths and weaknesses of each alternative to make an informed decision.
4. Decision making:
  - Select the best alternative based on the analysis and evaluation carried out.
  - Consider the possible risks, consequences and benefits of the decision made.
5. Implementation:
  - Plan the execution of the selected decision.
  - Assign resources and define responsibilities to complete the implementation successfully.
6. Monitoring and evaluation:
  - Monitor the progress of the implementation of the decision.
  - Make the necessary changes and evaluate the results obtained.

To solve problems related to decision making, several multi-criteria procedures have been developed, as documented in the scientific literature [15, 16]. Given the need to assign weights to different alternatives, ranking and aggregation procedures appear to be viable tools with practical application [16].

In the spectrum of classical multicriteria procedures is the linear weighting approach. This procedure involves calculating an overall score for each alternative [19].

Linear weighting is presented as a compensatory procedure applied after prior normalization. This approach is used in situations where a set of alternatives and criteria is developed [20-22].

In the field of multicriteria procedures, neutrosophic numbers were introduced with the aim of representing Neutrosophic [13]. These numbers form the basis of mathematical theories that generalize classical and fuzzy theories, such as neutrosophic groups and neutrosophic logic [15]. A neutrosophic number (N) is represented as follows [12]:

In the context of neutrosophic numbers, three fundamental components are defined:

- T: represents the dimension of space that denotes truth.
- I: represents the dimension that symbolizes the lie.
- F: represents the dimension that indicates indeterminacy.

Mathematically, a neutrosophic linear weighting procedure can be defined as a triple tuple (R, W, r), as expressed in equation 2.

$$(T_j = \sum w_j(T_j, I_j, F_j)) \quad (2)$$

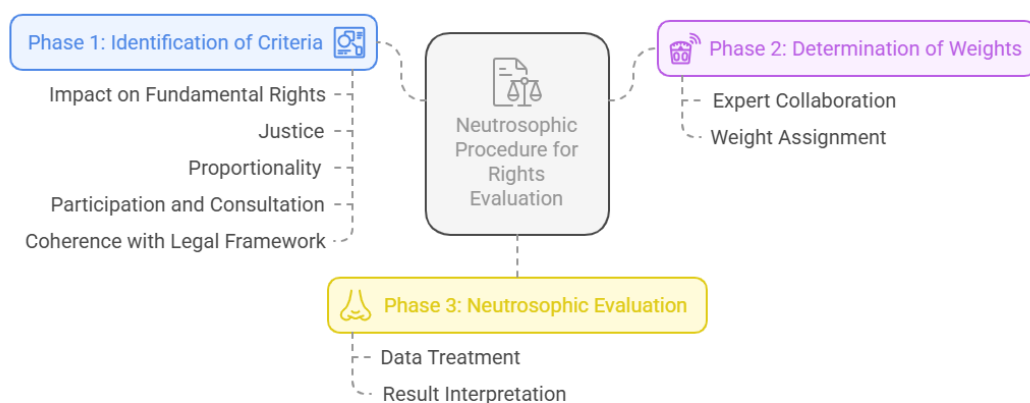
-( $T_j, I_j, F_j$ ) represents the resulting function that assigns a dimension to the space of truth, falsity, and indeterminacy (to criterion j)

-  $w$ : represents the weight of criterion j associated with the dimensions of the space of truth, falsity and indeterminacy ( $T, I, F$ ).

-  $T_j$ : represents the evaluation of the alternative  $i$  compared to the criterion  $j$ , linked to the dimensions of the space of truth, falsehood and indeterminacy.

### 3 MATERIAL AND METHODS

The proposed procedure was specifically designed to evaluate the weight of rights in the Ecuadorian context. Its operation is based on multi-criteria and multi-expert techniques, in which uncertainty is modeled for its identification. To perform this task, the multi-criteria neutrosophic linear weighting procedure is used.



**Figure 1.** Neutrosophic Procedure for Rights Evaluation in Ecuador

The procedure is structured in three main phases that, as a group, determine the main conclusions. These phases are designed sequentially to effectively address the review of the rights evaluation in Ecuador, taking into account the complexity and variety of factors involved in this process.

Each step of the procedure focuses on specific aspects of the evaluation, from data collection and identification of relevant criteria to the application of the neutrosophic linear weighting technique and the interpretation of the results obtained. The combination of these three steps provides a comprehensive view of the burden of rights in the Ecuadorian context, allowing the identification and resolution of significant inefficiencies or challenges in this area.

#### **Phase 1: Identification of evaluation criteria.**

To systematically formalize the diverse factors involved in evaluating how rights should be prioritized, a multi-criteria approach proves highly effective. This methodology entails recognizing and appraising a range of pertinent factors that influence the relative importance of rights in a specific setting. By dissecting the issue into several key criteria, decision-makers can achieve a more structured, transparent, and balanced assessment process.

Employing a multi-criteria framework is crucial because it accommodates the complex interplay of legal, ethical, and contextual considerations that shape the weighing of rights. Rather than relying on a single metric or subjective judgment, this approach allows for a nuanced analysis where each influencing factor is clearly defined and systematically evaluated. Such rigorous formalization not only enhances consistency and fairness in decision-making but also bolsters the legitimacy of the outcomes by providing a clear rationale for how rights are balanced. Below, we present a formalization of this group of criteria:

Let  $D$  be the group of criteria that are evaluated to evaluate the weighting of rights, and let  $D_i$  (where  $i = 1, 2, \dots, n$ ) be each of the criteria in this group. Then group  $D$  can be represented as follows:

$$D = \{d_1, d_2, \dots, d_n\}$$

Below, there are some examples of possible criteria that could be part of this group:

1. Impact on fundamental rights: This criterion evaluates the impact that a decision or action has on the fundamental rights of the people involved, such as the right to life, liberty, equality and dignity.
2. Justice: assess whether the consideration of rights guarantees fair and equitable treatment for all parties involved, regardless of their socioeconomic situation, gender, ethnic origin, or other characteristics.
3. Proportionality: this criterion evaluates whether the weighing of rights is carried out in proportion to the importance of the rights in conflict and the seriousness of the situation.
4. Participation and consultation: evaluate whether the opinions and points of view of all interested parties were taken into account in the rights review process, ensuring their active participation and the right to be heard.
5. Coherence with the legal framework and international human rights standards: This criterion evaluates whether the weighing of rights is carried out by the principles and standards established in national and international human rights legislation.

These are just some examples of possible criteria that could be part of group  $D$  when evaluating the weighting of rights. The selection and weighting of these criteria will depend on the context and the specific objectives of the evaluation.

$$C = \{c_1, \dots, c_n\}, n \geq 2, \text{ criteria.}$$

#### **Phase 2: Determination of weights.**

A multi-expert approach allows you to determine the weights associated with skills so that:

$$C = \{c_1, \dots, c_n\}, n \geq 2,$$

where represents the experts involved in the process.

#### **Step 3: Neutrosophic Evaluation.**

The evaluation phase represents the development of the procedure to produce the result of the proposed inference. The data are treated according to the linear weighting procedure using equation 4. As a result, the main criteria that determine the assessment of the weight of rights are evaluated.

#### 4 RESULTS.

To implement the proposed procedure, an analysis of the behavior of the evaluative indicators was carried out in a specific case study. This analysis allowed us to examine how the procedure was applied in practice and how the selected indicators responded.

In addition to analyzing the indicators, a survey was carried out to identify the causes and factors that influence the weight of rights in the context studied. This research provided valuable information on the perceptions and experiences of actors involved in the rights assessment process, leading to a better understanding of the challenges and opportunities related to this topic.

The combination of indicator analysis and survey results provided a more complete and detailed view of the weighting of rights in the case study. These results can serve as a basis for improving and adapting the proposed procedure, as well as identifying areas for improvement in the practical application of rights in the specific context analyzed.

##### Phase 1: Identification of evaluation criteria

For the analysis and operationalization of the proposed procedure, 6 evaluation criteria were used that must be met for subsequent evaluation, as shown in Table 1.

Below, a table that represents the 6 evaluation criteria used for the analysis and operation of the proposed procedure is presented:

1. Impact on fundamental rights:
  - Evaluation of the direct and indirect impact on people's fundamental rights.
2. Legal coherence:
  - Verification of the coherence of the weighting process with the national and international regulatory framework.
3. Net worth:
  - Assessment of justice in the distribution of benefits and burdens derived from the decision.
4. Citizen participation:
  - Participation analysis and consultation with interested parties during the weighting process.
5. Proportionality:
  - Assess whether the weighting of rights is carried out in proportion to the importance of the rights and the seriousness of the situation.
6. Effectiveness:
  - Measurement of the effectiveness and efficiency of the decisions resulting from the weighting process.

These evaluation criteria provide a structured framework to analyze and evaluate the balance of rights in a specific context. Each criterion addresses important aspects that must be taken into account during the evaluation process, such as the impact on fundamental rights, legal coherence, equity in the distribution of benefits and burdens, citizen participation and proportionality in the decision-making process. decisions.

##### Phase 2: Determination of weights.

For the phase of determining the weights attributed to the evaluation criteria, a consultation was carried out with 5 experts, who expressed their evaluations of the criteria. Leaderboards were generated from these ratings and then added to the resulting table. Table 2 presents the results of the evaluation of the criteria after carrying out the aggregation process.

Criterion	W
D1	[0.75,0.25,0.25]
D2	[0.90,0.15,0.25]
D3	[0.90,0.15,0.25]
D4	[0.80,0.25,0.25]
D5	[0.90,0.15,0.25]
D6	[1,0,15,0,10]

**Table 2:**Weighting assigned to the criteria according to specialized consultation.

##### Step 3: Evaluation of neutrosophic weight.

Depending on the evolution of the weights attributed to the alternatives and the evolution of the criteria defined by the analysis of the sample studied, the degree of membership of each criterion is determined through an aggregation process. Table 3 presents the result of the calculation carried out.

Criterion	Weight	$-(T_j, I_j, F_j)$	$T_j$
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D1	[0.75,0.25,0.25]	[0.75,0.10,0.15]	[0.28,0.10,0.15]
D2	[0.90,0.15,0.25]	[1,0,10,0,15]	[0.45,0.65,0.60]
D2	[0.90,0.15,0.25]	[0.75,0.10,0.15]	[0.45,0.65,0.60]
D3	[0.80,0.25,0.25]	[0.75,0.10,0.15]	[0.36,0.75,0.70]
D5	[0.90,0.15,0.25]	[1,0,10,0,15]	[0.45,0.65,0.60]
D6	[1,0,15,0,10]	[0.90,0.15,0.25]	[0.45,0.65,0.60]
Total			[0.40, 0.65, 0.60]

**Table 3:**Development of the decision-making system.

The neutrosophic evaluation of the balance of rights in Ecuador provides a structured approach to analyze decisions under uncertainty using the components of truth ( $T$ ), indeterminacy ( $I$ ), and falsity ( $F$ ). The results reveal moderate satisfaction across evaluated criteria ( $T = 0.40$ ) but highlight high levels of indeterminacy ( $I = 0.65$ ) and falsity ( $F = 0.60$ ), suggesting ambiguity and significant shortcomings in the process. For instance, the impact on fundamental rights shows low falsity ( $F = 0.15$ ) and moderate truth ( $T = 0.28$ ), while criteria such as legal coherence and equity exhibit high levels of indeterminacy and falsity, reflecting challenges in regulatory clarity and distributive justice.

These findings underscore the need to enhance methodological clarity and stakeholder engagement to reduce indeterminacy and better align the process with rights-based objectives. Recommendations include adjusting the weighting of criteria, improving data collection, and ensuring more inclusive and proportional decision-making processes. This analysis identifies critical areas for refining the balance of rights, contributing to the effectiveness and legitimacy of the evaluation procedure.

## 5. CONCLUSION

The development of the neutrosophic procedure to evaluate the balance of rights highlights its essential role in constitutional law and human rights in Ecuador. The inherent conflicts between constitutional rights and principles are especially pronounced in situations involving vulnerable groups requiring special protection. This procedure offers a structured approach to address these complexities while ensuring transparency and objectivity in the decision-making process.

The jurisprudential analysis reveals that the balance of rights has been applied across various contexts in Ecuador's legal system. While judges and authorities have made significant efforts to resolve regulatory conflicts and protect the interests of vulnerable groups, instances of insufficient knowledge or improper application of weighting principles have been identified. These shortcomings can jeopardize the effective safeguarding of the rights of society's most vulnerable members.

To address these challenges, the inclusion of a specific rule on the weighing of rights in the Organic Law of Jurisdictional Guarantees and Constitutional Control is proposed. This addition would establish clear, objective criteria for rights evaluation, equipping judges with a robust framework to resolve regulatory disputes fairly and equitably. Such a measure would enhance the protection of vulnerable groups, ensuring their rights are upheld comprehensively. However, for this approach to be effective, it is imperative to provide judges and authorities with thorough training in constitutional principles and human rights. An interdisciplinary perspective is also crucial to consider the unique circumstances of each case and the specific needs of affected vulnerable groups. These steps would strengthen the application of the neutrosophic procedure and contribute to a more equitable legal system.

**RECEIVED: JULY, 2024.**  
**REVISED: DECEMBER, 2024.**

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