



Application of the Neutrosophic TOPSIS for the Analysis of the Violation of Due Process in Ecuadorian Adolescents

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Abstract

Due to the increase in violence in Ecuador involving juvenile offenders, an analysis of the situation is proposed from a neutrosophic approach to address the violation of due process in adolescents in Ecuador, highlighting the importance of considering the complexities and ambiguities of the juvenile penal system. Challenges are identified and classified through the PESTEL technique related to legal deficiencies, economic constraints, and socio-environmental factors contributing to juvenile delinquency, which are processed hermeneutically in a TOPSIS that uses single-valued neutrosophic numbers. The processing's main outcome is the influence of legal and economic aspects, thus the need to promote legal reforms, strengthen institutional capacities, invest in preventive programs, and support social reintegration and the responsible use of information technologies. The conclusions emphasize the importance of a comprehensive and coordinated approach to improve juvenile justice in Ecuador, ensuring respect for due process and the rights of adolescents.

Keywords: violence in Ecuador; due process; juvenile penal system; PESTEL; hermeneutic analysis; neutrosophic TOPSIS approach.

1. Introduction

Considering the rise in violence in Ecuador over the last 10 years, the Penal Code was amended in 2014 to incorporate changes in the treatment of juvenile offenders, distinguishing them from children [1]. According to Ecuadorian law, one can be prosecuted under the term "infants," which allows for gender-neutral language and subjects them to administrative welfare measures. On the other hand, the term "adolescents" is already embraced by the justice system [2]. An Adolescent in

conflict with the law is understood as individuals between the ages of 12 and 18 who have committed infractions typified in the Comprehensive Organic Penal Code, leading to their subjection to socio-educational measures due to their responsibility in accordance with the legal precepts of the Childhood and Adolescence Code [3].

Various causes of these behaviors have been identified:

- poverty,
- lack of inclusion in a group,
- lack of a family,
- family disintegration,
- psychological traumas,
- their use by organized groups to commit crimes,
- stigmatization, and
- genetic predispositions [4].

All of these have been identified to achieve treatment in accordance with what is established in the Code for Children and Adolescents, whose purpose is the protection and development of juvenile offenders, to guarantee their education, family integration, and constructive inclusion into society [5]. Additionally, to ensure that the rights of adolescents in conflict with penal law are respected as a fundamental principle of law that establishes that every person, including adolescents in conflict with the law, should be treated fairly and equitably during a legal process, is enshrined in the Constitution of the Republic and the Comprehensive Organic Penal Code (COIP).

Due Process is [6]:

- The universal, indispensable, fundamental right that every person has to access justice without delay, meaning that every person has the right to defense with guarantees and equity, practically constitutes protection for the accused.
- A constitutional right that protects the litigants so that the state organ acts under the law and legally develops the procedure based on the strictest axiological principles and justice.

It includes the following guarantees [6]:

1. No one shall be deprived of the right to defense at any stage or level of the process.
2. Have adequate time and means for the preparation of their defense.
3. Be heard at the appropriate time and on equal terms.

4. The procedures will be public except for exceptions provided by law.
5. No one may be questioned, even for investigative purposes, by the general prosecutor's office, any police authority, or by any other authority, without the presence of their chosen lawyer or a public defender, nor outside the authorized premises for this purpose.
6. Be assisted by a translator or interpreter if they do not understand or speak the language in which the procedure is conducted.
7. In judicial proceedings, be assisted by a lawyer of their choice or by a public defender.
8. Present verbally or in writing the reasons or arguments of their case and reply to the arguments of other parties.
9. No one may be tried more than once for the same cause and matter; cases resolved by indigenous jurisdiction must be considered for this purpose.
10. Be judged by an independent, impartial, and competent Judge.

In the case of adolescents, the due process acquires special relevance due to their condition as developing individuals with specific needs. That is why the Comprehensive Organic Penal Code (COIP) establishes a special regime for the trial of juvenile offenders, which is based on the following principles:

- Comprehensive protection: The State must guarantee the comprehensive protection of the rights of adolescents, including their right to life, health, education, freedom, and personal security.
- Best interests of the child: In all decisions made regarding an adolescent in conflict with the law, their best interest must be considered.
- Progressive responsibility: The responsibility of adolescents for their actions should be gradual and proportional to their level of maturity and development.
- Socio-educational measures: The measures applied to juvenile offenders should aim at their social and family reintegration.

Due process in the trial of juvenile offenders includes the following stages:

- Investigation: The General Prosecutor's Office conducts the crime investigation and gathers the necessary evidence to determine the adolescent's responsibility.
- Charge formulation hearing: In this hearing, the Prosecutor presents the charges against the adolescent, and the judge determines if there is enough evidence to start a trial.

- Trial: In the trial, the evidence and arguments from the parties are presented. The judge or court decides if the adolescent is responsible for the crime and, if so, imposes a socio-educational measure.

Due process applies not only during the trial but also at all stages of the legal process, from investigation to the implementation of the socio-educational measure, since the main focus is on rehabilitation, not punishment. Therefore, due process in the context of adolescents in conflict with the law, especially considering the rise in violence in Ecuador, constitutes a topic of significant importance within the legal and social framework of the country. This principle, fundamental in any rule of law, acquires specific peculiarities when it involves minors, who, due to their developmental condition and vulnerability, require specialized and differentiated treatment that guarantees not only their adequate legal representation and protection of their rights but also their effective reintegration into society [7,8].

Therefore, its violation constitutes a serious issue within the Ecuadorian judicial system and, consequently, requires constant analysis and supervision, as there have been situations that undermine compliance with legislation. Hence, the study of this phenomenon is necessary to offer solutions that lead to strict adherence to due process, especially to prevent jeopardizing the reintegration of adolescents into society. This approach focuses on ensuring respect for due process and judicial guarantees, adequate criminal responsibility, prevention of violence and promotion of safe environments, restorative justice, and social reintegration.

Given the above, the observation of the process and the constant study of its deviations become essential, a need that leads to the analysis of its violation, which is stated as the main objective of the research. This analysis will be carried out through multicriteria decision methods in a neutrosophic environment because:

- The multicriteria and multi-expert analysis facilitates the evaluation of various variables and criteria, incorporating the opinions of multiple experts.
- The management of uncertainty, indeterminacy, and contradiction through neutrosophic numbers helps to obtain a broader spectrum of aspects that affect the evaluation of cases involving adolescents.
- They offer a comprehensive evaluation that considers the legal, social, and personal aspects of adolescents, facilitating fairer decisions aimed at their welfare and reintegration.

2. Methods

To analyze the problem, a methodological approach is used that includes the application of surveys, an exhaustive literature review, and the implementation of the PESTEL method. The latter is a descriptive framework that allows for examining the context in which the phenomenon develops by identifying political, economic, sociocultural, technological, ecological, and legal factors that can influence its proper execution. For the methodology of applying PESTEL, see [9,10].

The data processing is carried out in a neutrosophic environment using the Technique for Order of Preference by Similarity to the Ideal Solution (TOPSIS) method, which is used for the evaluation of factors that violate the process. All this is under the criterion of experts related to the phenomenon analyzed [11] and whose methodology is shown below:

Definition 1. Let X be a space of points (objects) with generic elements in X denoted by x . A single-valued neutrosophic set (SVNS) A in X is characterized by the truth-membership function $T_A(x)$, indeterminacy-membership function $I_A(x)$, and falsity membership function $F_A(x)$. Then, an SVNS A can be denoted by $A = \{x, T_A(x), I_A(x), F_A(x) \mid x \in X\}$, where $T_A(x), I_A(x), F_A(x) \in [0,1]$ for each point x in X . Therefore, the sum of $T_A(x), I_A(x)$ and $F_A(x)$ satisfies the condition $0 \leq T_A(x) + I_A(x) + F_A(x) \leq 3$.

For convenience, an SVN number is denoted by $A = (a \ b \ c)$, where $a, b, c \in [0,1]$ and $a + b + c \leq 3$

Definition 2. Let $A_1 = (a_1, b_1, c_1)$ and $A_2 = (a_2, b_2, c_2)$ be two SVN numbers, then summation between A_1 y A_2 is defined as follows:

$$A_1 + A_2 = (a_1 + a_2 - a_1a_2, b_1b_2, c_1c_2) \quad (1)$$

Definition 3. Let $A_1 = (a_1, b_1, c_1)$ and $A_2 = (a_2, b_2, c_2)$ be two SVN numbers, then multiplication between A_1 y A_2 is defined as follows:

$$A_1 * A_2 = (a_1a_2, b_1 + b_2 - b_1b_2, c_1 + c_2 - c_1c_2) \quad (2)$$

Definition 4. Let $A = (a, b, c)$ be an SVN number and $\lambda \in \mathbb{R}$ an arbitrary positive real number, then:

$$\lambda A = (1 - (1 - a)^\lambda, b^\lambda, c^\lambda), \lambda > 0 \quad (3)$$

Definition 5. Let $A = \{A_1, A_2, \dots, A_n\}$ be a set of n SVN numbers, where $A_j = (a_j, b_j, c_j)$ ($j = 1, 2, \dots, n$). The single-value neutrosophic weighted average operator on them is defined by

$$\sum_{j=1}^n \lambda_j A_j = \left(1 - \prod_{j=1}^n (1 - a_j)^{\lambda_j}, \prod_{j=1}^n b_j^{\lambda_j}, \prod_{j=1}^n c_j^{\lambda_j}\right) \quad (4)$$

Where λ_j is the weight of A_j ($j = 1, 2, \dots, n$), $\lambda_j \in [0,1]$ and $\sum_{j=1}^n \lambda_j = 1$

Definition 6. Let $A^* = \{A_1^*, A_2^*, \dots, A_n^*\}$ be a vector of n SVN numbers, such that $A_j^* = (a_j^*, b_j^*, c_j^*)$ ($j = 1, 2, \dots, n$), and $B_i = \{B_{i1}, B_{i2}, \dots, B_{im}\}$ ($i = 1, 2, \dots, m$), ($j = 1, 2, \dots, n$). Then the separation measure between B_i and A^* based on Euclidian distance is defined as follows:

$$s_i = \left(\frac{1}{3} \sum_{j=1}^n (|a_{ij} - a_j^*|)^2 + (|b_{ij} - b_j^*|)^2 + (|c_{ij} - c_j^*|)^2\right)^{\frac{1}{2}} \quad (5)$$

($i = 1, 2, \dots, m$)

Next, we proposed a score function for ranking SVN numbers as follows:

Definition 7. Let $A = (a, b, c)$ be a single-valued neutrosophic number, a score function S of a single-valued neutrosophic value, based on the truth-membership degree, indeterminacy-membership degree and falsity membership degree is defined by

$$S(A) = \frac{1+a-2b-c}{2} \tag{6}$$

where $S(A) \in [-1,1]$

The score function S is reduced to the score function if $b = 0$ and $a + b \leq 1$.

The concept of a linguistic variable is very useful for solving decision-making problems with complex content. The value of a linguistic variable is expressed as an element of its term set. Such linguistic values can be represented using single-valued neutrosophic numbers. In the method, there are k -decision makers, m -alternatives and n -criteria. k -decision makers evaluate the importance of the m -alternatives under n -criteria and rank the performance of the n -criteria with respect to linguistic statements converted into single valued neutrosophic numbers. The importance weights based on single-valued neutrosophic values of the linguistic terms are given in Table 1.

Table 1: Linguistic variable and SVNNS. Note: Source: [11, 12]

Linguistic term	SVNSs
Very influential/(VI)	(0.9;0.1;0.1)
influential /(I)	(0.75;0.25;0.20)
Medium influential /(MI)	(0.50;0.5;0.50)
No influential /(NI)	(0.35;0.75;0.80)
Very no influential / (MNI)	(0.10;0.90;0.90)

Assuming $A = \{\rho_1, \rho_2, \dots, \rho_m\}$ is a set of alternatives and $G = \{\beta_1, \beta_2, \dots, \beta_n\}$ is a set of criteria, the following steps will be carried out:

Step 1: Determine the relative importance of the experts. For this, specialists evaluate according to the linguistic scale shown in Table 1, and calculations are made with their associated Single-Valued Neutrosophic Number (SVNN), let $A_t = (a_t, b_t, c_t)$ be the SVNN corresponding to the t -th decision-maker ($t = 1, 2, \dots, k$). The weight is calculated by the following formula:

Assuming that it is a set of alternatives and it is a set of criteria, the following steps will be carried out:

Step 1: Determine the relative importance of experts. To do this, the specialists evaluate according to the linguistic scale that appears in Table 1, and the calculations are carried out with its associated

NNVU, call $A_t = (a_t, b_t, c_t)$ the SVNS corresponding to the t -th decision maker ($t = 1, 2, \dots, k$). The weight is calculated by the following formula:

$$\delta_t = \frac{a_t + b_t \left(\frac{a_t}{a_t + c_t} \right)}{\sum_{t=1}^k a_t + b_t \left(\frac{a_t}{a_t + c_t} \right)} \quad (7)$$

$$\delta_t \geq 0 \text{ and } \sum_{t=1}^k \delta_t = 1$$

Step 2: Construction of the aggregated single-valued neutrosophic decision matrix. This matrix is defined by $D = \sum_{t=1}^k \lambda_t D^t$, where $d_{ij} = (u_{ij}, r_{ij}, v_{ij})$ and is used to aggregate all the individual evaluations. d_{ij} is calculated as the aggregation of the evaluations given by each expert $(u_{ij}^t, r_{ij}^t, v_{ij}^t)$, using the weights λ_t of each with the help of Equation 4. In this way, a matrix $D = (d_{ij})_{ij}$ is obtained, where each d_{ij} is an SVNN ($i = 1, 2, \dots, m; j = 1, 2, \dots, n$).

Step 3: Determination of the Criteria Weight. Assume the weight of each criterion is given by $W = (w_1, w_2, \dots, w_n)$, where w_j denotes the relative importance of the criterion $\lambda_t w_j^t = (a_j^t, b_j^t, c_j^t)$, if it is the evaluation of the criterion λ_t by the t -th expert. Then Equation 4 is used to aggregate the w_j^t with the weights λ_t .

Step 4: Construction of the weighted average single-valued neutrosophic decision matrix with respect to the criteria.

$$D^* = D * W, \quad (8)$$

$$\text{where } d_{ij} = (a_{ij}, b_{ij}, c_{ij})$$

Step 5: Calculation of the positive and negative Single-Valued Neutrosophic Number (SVNN) ideal solutions. Criteria can be classified as cost type or benefit type. Let G_1 be the set of benefit type criteria and G_2 the cost type criteria. The ideal alternatives will be defined as follows:

The positive ideal solution that corresponds to G_1 .

$$\rho^+ = (a_{\rho^+w}(\beta_j), b_{\rho^+w}(\beta_j), ac_{\rho^+w}(\beta_j)) \quad (9)$$

The negative ideal solution that corresponds to G_2 .

$$\rho^- = (a_{\rho^-w}(\beta_j), b_{\rho^-w}(\beta_j), ac_{\rho^-w}(\beta_j)) \quad (10)$$

Where:

$$a_{\rho^+w}(\beta_j) = \begin{cases} \max_i a_{\rho^+w}(\beta_j), & \text{si } j \in G_1 \\ \min_i a_{\rho^+w}(\beta_j), & \text{si } j \in G_2, \end{cases} \quad a_{\rho^-w}(\beta_j) = \begin{cases} \min_i a_{\rho^-w}(\beta_j), & \text{si } j \in G_1 \\ \max_i a_{\rho^-w}(\beta_j), & \text{si } j \in G_2, \end{cases}$$

$$b_{\rho^+w}(\beta_j) = \begin{cases} \max_i b_{\rho^+w}(\beta_j), & \text{si } j \in G_1 \\ \min_i b_{\rho^+w}(\beta_j), & \text{si } j \in G_2, \end{cases} \quad b_{\rho^-w}(\beta_j) = \begin{cases} \min_i b_{\rho^-w}(\beta_j), & \text{si } j \in G_1 \\ \max_i b_{\rho^-w}(\beta_j), & \text{si } j \in G_2, \end{cases}$$

$$c_{\rho+w}(\beta_j) = \begin{cases} \max_i c_{\rho iw}(\beta_j), & \text{si } j \in G_1 \\ \min_i c_{\rho iw}(\beta_j), & \text{si } j \in G_2, \end{cases} \quad c_{\rho-w}(\beta_j) = \begin{cases} \min_i c_{\rho iw}(\beta_j), & \text{si } j \in G_1 \\ \max_i c_{\rho iw}(\beta_j), & \text{si } j \in G_2, \end{cases}$$

Step 6: Calculation of the distances to the positive and negative SVN ideal solutions. With the help of Equation 5, the following equations are calculated:

$$d_i^+ = \left(\frac{1}{3} \sum_{j=1}^n \left\{ (a_{ij} - a_j^+)^2 + (b_{ij} - b_j^+)^2 + (c_{ij} - c_j^+)^2 \right\} \right)^{\frac{1}{2}} \quad (11)$$

$$d_i^- = \left(\frac{1}{3} \sum_{j=1}^n \left\{ (a_{ij} - a_j^-)^2 + (b_{ij} - b_j^-)^2 + (c_{ij} - c_j^-)^2 \right\} \right)^{\frac{1}{2}} \quad (12)$$

Step 7: Calculation of the Coefficient of Proximity (CP). The CP of each alternative is calculated with respect to the positive and negative ideal solutions.

$$\tilde{\rho}_j = \frac{s^-}{s^+ + s^-} \quad (13)$$

Where $0 \leq \tilde{\rho}_j \leq 1$.

Step 8: Determination of the order of alternatives. They are ordered according to the performance of $\tilde{\rho}_j$. The alternatives are ranked from highest to lowest, with the condition that $\tilde{\rho}_j \rightarrow 1$ is the optimal solution.

3. Information processing

4. In the analysis of the problem, factors are identified and classified according to the dimensions of PESTEL as outlined in [3,5,7,8,13-27]:

- **Political Aspects:** The necessity to ensure the swift progression of judicial processes to prevent the defenselessness of adolescents, in line with constitutional rights, contrasts with corruption within the judicial system affecting access to justice for adolescents. Despite the political will of the government, there exists in practice a lack of coordination among the different institutions responsible for juvenile justice, such as the police and the prosecution.
- **Economic Aspects:** The violation of due process due to a lack of resources for preventive actions that could help avoid criminal behaviors. Poverty is a vulnerability factor for adolescents towards crime since the lack of economic resources cannot always be supplemented by the state's resources. The state does not always have sufficient economic resources to invest in prevention programs and attention to adolescents in conflict with the law.
- **Social Aspects:** The lack of human values, empathy, and abuse of power are key elements that affect the violation of these individuals' rights. The loss of ethical values that lead to situations of non-compliance with legal norms, especially by public officials, as well as social stigmatization, lead to discrimination by society and hinder their social reintegration. All this

is compounded by the lack of family support and proper follow-up to the processes of adolescents. Family disintegration, along with the lack of educational and employment opportunities, goes against the compliance and main goal of processing adolescents, which is their reintegration into society.

- **Technological Aspects:** Indiscriminate use, as well as inappropriate use of technology and the circulation of unverified information, affect the superior interest of adolescents, compromising their well-being with the circulation of fake news that leads to prejudice and the violation of the principle of innocence within due process. Likewise, the lack of access to information and communication technologies hinders access to justice for adolescents since both the involved party and their families do not obtain the necessary information or documentation as a means for their defense.
- **Ecological Aspects:** Interaction with polluted environments, such as the consumption of narcotics by adolescents, leads to criminal behaviors and the violation of their rights.
- **Legal Aspects:** Deficiencies in the administration of justice, outdated penal legislation, and an inefficient penitentiary regime hinder effective compliance with the constitutional mandate on comprehensive protection and the superior interest of the child and adolescent. The importance of complying with the Code for Children and Adolescents to ensure full respect for due process and the established judicial guarantees lies in carrying out each of the process phases, which does not happen in practice due to factors ranging from a lack of training, inadequate laws resulting in process delays, or on the contrary, trials that are too rapid without competent defenders explaining the true causes.

The analysis of the information is carried out using the methods presented, utilizing single-valued neutrosophic numbers for evaluation. This approach enables the handling of the uncertainty and indeterminacy inherent in the personal judgments of experts within this type of legal social phenomenon. For the execution of the study, experts are selected from the following positions:

1. Juvenile judges (3)
2. Prosecutors (2)
3. Public defenders (4)
4. Social workers (2)
5. Families of adolescents in conflict with the law (7)

The criteria issued for the evaluation of the problem, which are used by the groups to evaluate the PESTEL factors, are:

1. **Relevance:** allows determining whether the factor is directly related to the violation of due process in adolescents in conflict with the law. A relevant factor has a significant impact on the adolescents' ability to access a fair trial. If a factor is not relevant, it is not necessary to consider it.

2. **Impact:** allows determining the magnitude of the factor's impact on the violation of due process. A factor with a high impact affects a large number of adolescents or has a severe impact on their rights.
3. **Trend:** allows determining whether the impact of the factor is increasing or decreasing. A factor with an increasing trend may have a greater impact in the future.
4. **Control capacity:** allows determining whether it is possible to control or mitigate the impact of the factor. A factor with high control capacity can be modified through public policies or specific programs.
5. **Equity:** allows determining whether the impact of the factor affects all adolescents equitably or discriminates against certain groups. An equitable factor has a similar impact on all adolescents, regardless of their social, economic, or cultural background.

Table 2: Weight of decision-makers. Source: Own elaboration

Weight	Juvenile Judges	Prosecutors	Public Defenders	Social Workers	Families of adolescents in conflict with the law
importance vector	M	I	VI	VI	M

Subsequently, the valuation of the alternatives according to the criteria by each of the decision-makers is executed using the SVNNs and the weights for each criterion and by alternatives. Tables 3 and 4 show the average results. For the calculation of the averages, definition 5 from section 2 of this document is used.

Table 3: Matrix of single value criteria. Source: Own elaboration

Alternatives	1. Relevance	2. Impact	3. Trend	4. Controllability	5. Equity
Political	(0.30179;0.78067;0.82099)	(0.87768;0.12232;0.11646)	(0.38869;0.6468;0.66347)	(0.4507;0.5493;0.5493)	(0.6552;0.3448;0.3448)
Economic	(0.80901;0.19099;0.17524)	(0.55431;0.44569;0.42949)	(0.8624;0.1376;0.12731)	(0.8694;0.1306;0.1306)	(0.8163;0.1837;0.1837)
Social	(0.16214;0.86464;0.87699)	(0.20618;0.83888;0.86002)	(0.21799;0.83186;0.85537)	(0.2631;0.8046;0.8372)	(0.2104;0.8364;0.8584)
Ecological	(0.26306;0.80465;0.83719)	(0.31551;0.70557;0.71529)	(0.54759;0.73338;0.49345)	(0.4964;0.8164;0.7174)	(0.5554;0.7207;0.6334)

Legal	(0.83169;0.16831;0.14826)	(0.82582;0.17418;0.15216)	(0.82707;0.17293;0.15133)	(0.9;0.1;0.1)	(0.9;0.1;0.1)
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Table 4: Weights of the criteria according to the experts. Source: Own elaboration

Criterion	Criterion weight
1. Relevance	(0.82707;0.17293;0.15133)
2. Impact	(0.82707;0.17293;0.15133)
3. Trend	(0.81831;0.18169;0.1571)
4. Controllability	(0.77584;0.23133;0.21308)
5. Equity	(0.7426;0.37688;0.26092)

Table 5: Weighted decision matrix of the SVNNS. Source: Own elaboration

Alternatives	1. Relevance	2. Impact	3. Trend	4. Controllability	5. Equity
Political	(0.2496;0.8186;0.84808)	(0.7259;0.2741;0.25017)	(0.31807;0.71097;0.71634)	(0.34967;0.65356;0.64534)	(0.48655;0.59173;0.51575)
Economic	(0.66911;0.33089;0.30005)	(0.45845;0.54155;0.51583)	(0.70571;0.29429;0.26441)	(0.67452;0.33172;0.31585)	(0.60618;0.49135;0.39669)
Social	(0.1341;0.88805;0.89561)	(0.17053;0.86674;0.8812)	(0.17838;0.86241;0.87809)	(0.20412;0.8498;0.87189)	(0.15624;0.89806;0.89535)
Ecological	(0.21757;0.83843;0.86183)	(0.26095;0.75649;0.75838)	(0.4481;0.78182;0.57303)	(0.38513;0.85887;0.77762)	(0.41244;0.82596;0.72905)
Legal	(0.68787;0.31213;0.27715)	(0.68301;0.31699;0.28046)	(0.6768;0.3232;0.28466)	(0.69826;0.3082;0.29177)	(0.66834;0.43919;0.33483)

Table 6: Positive and negative ideal values. Source: Own elaboration

Sense	Criterion	Ideal value +	Ideal value -
max	1. Relevance	(0.68787;0.31213;0.27715)	(0.1341;0.88805;0.89561)
max	2. Impact	(0.7259;0.2741;0.25017)	(0.17053;0.86674;0.8812)
max	3. Trend	(0.70571;0.29429;0.26441)	(0.17838;0.86241;0.87809)
max	4. Controllability	(0.69826;0.3082;0.29177)	(0.20412;0.8498;0.87189)
max	5. Equity	(0.66834;0.43919;0.33483)	(0.15624;0.89806;0.89535)

Figure 1 shows the proximity coefficient along with the ideal distances, using Definition 7 and the score function $S(A)$ for the deneutrosophication of the value. It is observed that the highest values of the proximity coefficient are associated with legal and economic aspects, meaning that these two aspects are critical in addressing adolescent violence.

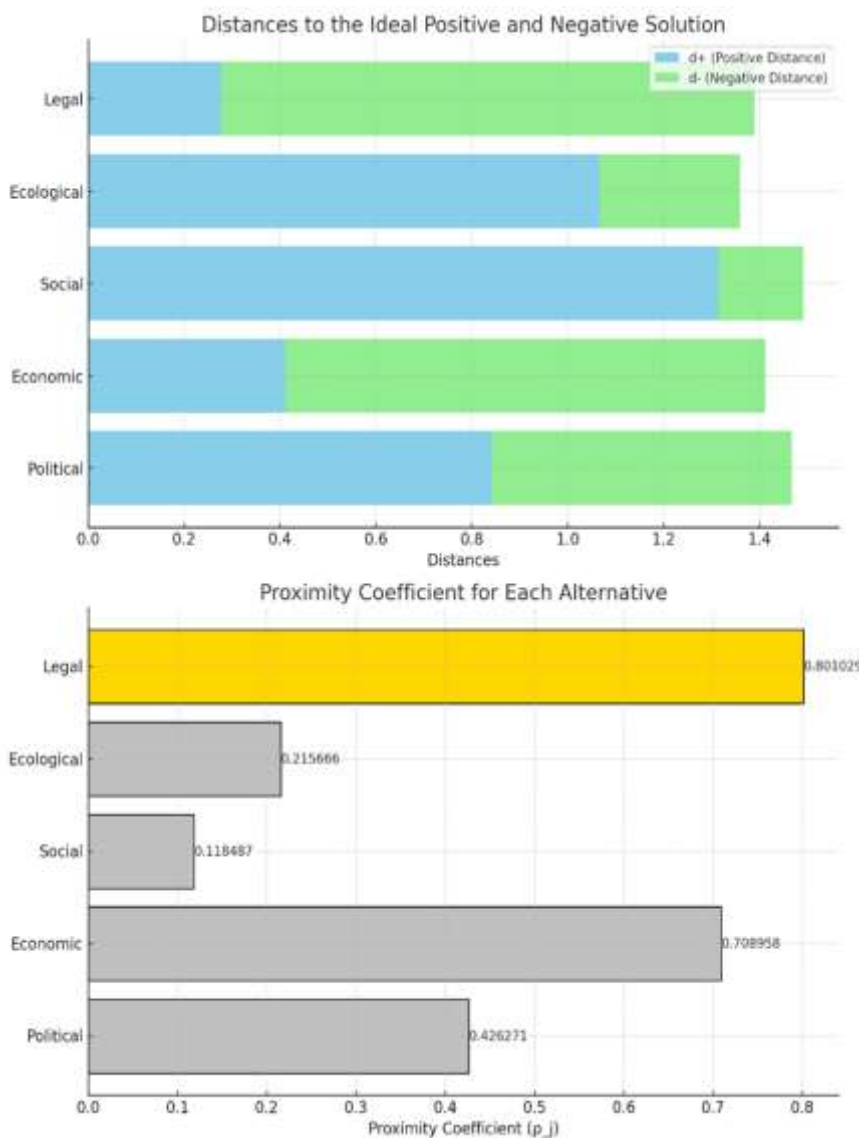


Figure 1: Calculation of d_i^+ , d_i^- and \tilde{p}_j . Source: Own elaboration.

The legal and economic dimensions are crucial for understanding the challenges in the effective enforcement of due process for adolescents in Ecuador. Deficiencies in the administration of justice, along with outdated penal legislation and an ineffective penitentiary system, are the primary legal obstacles. From an economic perspective, the vulnerability of adolescents to crime is exacerbated by poverty and a lack of state investment in prevention and care programs. Both dimensions require urgent attention to ensure comprehensive protection and respect for the due process rights of adolescents, in line with the criteria of relevance, impact, trend, control capacity, and equity.

To effectively address the identified challenges, it is essential to adopt a holistic and multifaceted approach. First, strengthening institutional capacities and improving inter-institutional coordination are crucial for more efficient and consistent juvenile justice. Investment in preventive programs should be prioritized, focusing efforts on mitigating risk factors associated with juvenile delinquency. The social reintegration of adolescents should focus on education and employment, ensuring family and

community support. It is imperative to regulate the use of technologies to protect adolescents in the digital environment and to address the environmental and social factors that predispose them to criminal behavior. Finally, a thorough review of penal legislation and a reform of the penitentiary system are essential to ensure fair processes and respect for the rights of adolescents.

6. Conclusion

To analyze the challenges faced in enforcing due process for adolescents in Ecuador, this study employs a comprehensive methodological approach, incorporating surveys, an exhaustive literature review, and the application of the PESTEL framework. This descriptive tool allows for an in-depth examination of the political, economic, sociocultural, technological, ecological, and legal factors influencing the phenomenon's context. Moreover, the study delves into a neutrosophic environment for data processing, utilizing the Technique for Order of Preference by Similarity to the Ideal Solution (TOPSIS) for evaluating factors that impede the process, guided by expert opinions related to the analyzed phenomenon.

The findings highlight the critical roles of legal and economic dimensions in the effective implementation of due process for adolescents. Legal obstacles include deficiencies in the justice system, outdated legislation, and an ineffective penitentiary regime. Economically, the vulnerability of adolescents to crime is intensified by poverty and insufficient state investment in preventive and care programs. Addressing these issues necessitates a holistic approach: enhancing institutional capacities, fostering inter-institutional coordination, investing in preventive programs, focusing on the social reintegration of adolescents through education and employment opportunities, regulating technology use to safeguard adolescents online, and revising penal legislation and penitentiary system reforms. Such comprehensive measures are essential for ensuring the comprehensive protection and due process rights of adolescents, emphasizing the importance of relevance, impact, trend, control capacity, and equity in these endeavors. **Funding:** "This research received no external funding"

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