Analysis of the application of extenuating circumstances using the Torgerson method with SVNN

Mónica I. M.Verdezoto, Alex F.S.Moreno, Pablo M.V. Acosta

Regional Autonomous University of the Andes (UNIANDES), Ambato, Ecuador

Email: ua.monicamora@uniandes.edu.ec; ua.alexsolano@uniandes.edu.ec; ua.pablovaca@uniandes.edu.ec

Abstract

The extenuating circumstances are a vital element allowing the reduction of the penalty for the committed crime. However, despite being regulated, they present certain inconsistencies in their application since it directly impacts the demonstration or not of the legal materiality of the offense and the accused's responsibility. Today in Ecuador, a situation of inapplicability persists in different parts of the country for which it is decided to carry out the present investigation. The objective is to study the main causes of the tendency to non-application of extenuating circumstances. For this, the work authors rely on the Torgerson method and single-valued neutrosophic numbers due to the facilities they offer for this type of analysis.Finally, to finish the work, possible solutions to mitigate the phenomenon analyzed are enunciated.

Keywords: extenuating circumstances; inapplicability; Torgerson; SVNN

1. Introduction

Extenuating circumstances reduce the penalty of the crime with attention to some requirements established in the law. In extenuating circumstances, the spirit of the aggressor prevails considerably after having committed the injurious action"[1]. They are established in article 45 of the Integral Organic Criminal Code where their application influences the preventive detention, they are presented by the defense lawyer before the case's judge [2]. The referred article establishes the following as extenuating circumstances [3]:

1. Committing criminal offenses against property without violence, under the influence of dire economic circumstances;
2. Acting the offending person out of intense fear or under violence;
3. Attempting, voluntarily, to annul or lessen the consequences of the offense or to provide immediate help and assistance to the victim;
4. Voluntarily repair the damage or fully compensate the victim;

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5. Present yourself voluntarily to the judicial authorities, being able to have eluded their action by escape or concealment;

6. Collaborate effectively with the authorities in the investigation of the infraction

According to [1]:

When the legislators elaborated the Integral Organic Criminal Code, they took into consideration the use of the well-known Criminal Policy, they created a fully punitive Code increasing the penalties for each crime, increasing the aggravating circumstances, and greatly reducing the extenuating circumstances; subtracting from the Judges the space of freedom to apply more balanced resolutions and sentences, because extenuating circumstances are the closest step to establish the correct proportionality between the offense committed and the penalty imposed. (p. 2)

This has created situations of inapplicability since these imply reducing the penalty even when facing the defendant with sufficient elements of conviction. A situation that usually represents a confrontation between the defense attorneys and the prosecutors who in the *flagrante delicto* qualification hearing, since it has a direct impact on the demonstration or not of the legal materiality of the offense and the responsibility of the defendant [1, 3-6]. This constitutes the problematic situation of this investigation.

Today in Ecuador, what is established by criminal law to treat extenuating circumstances presents certain irregularities in its application. Criminal legislation, classified as inquisitive [1], exposes 28 aggravating circumstances and only 6 extenuating circumstances [7]. Which generates prejudices against granting their favor. For which it is decided in this research to study the main causes of the tendency to its inapplicability. Some papers where Neutrosophy is applied in legal fields are [8-13].

From now on, this paper will be split into sections for the explanation of the methods and techniques to obtain and process the information, the results obtained, and their discussion. Thus ending with the conclusions and the bibliographic references used.

2. Methods for the collection and processing of information

- **Inductive method:** It establishes propositions of a general nature inferred from the observation and analytical study of particular facts and phenomena, its application allows to establish general conclusions derived precisely from the systematic and periodic observation of the real events that occur around the phenomenon in question.

- **Deductive method:** Deductive reasoning considered as the method, performs two functions of scientific research: first, to find the unknown principle of a known fact, it is about referring the phenomenon to the law that governs it and, second, discovering the unknown consequence of a known principle, this means that if we know a certain law we can apply it in particular cases related to the abbreviated procedure.

- **Analytical method:** To analyze an object means to understand its characteristics through the parts that make it up.It is making a separation of its components and periodically observing each one of them, to identify both their particular dynamics and the correspondence relationships that they have with each other and give rise to the general characteristics that one wants to know.

2.1 Neutrosophy

Neutrosophy is a mathematical theory developed by Romanian Scholar Florentin Smarandache to deal with indetermination [14]. It has been the base for developing new methods to deal with indeterminate

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and inconsistent information as neutrosophic sets, neutrosophic logic, and especially, in decision-making problems [15].For example, the truth value in the neutrosophic set is as follow [16]:

Definition 1 ([17-20]) Let X be a space of points (objects) with generic elements in X denoted by x. An single-valued neutrosophic set (SVNS) A in X is characterized by truth-membership function T_A (x), indeterminacy-membership function I_A (x), and falsehood membership function F_A (x). Then, an SVNS A can be denoted by A = {x, T_A(x), I_A(x), F_A(x) x ∈ X}, where T_A (x), I_A (x), F_A (x) ∈ [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 $0 \leq T_A(x) + I_A(x) + F_A(x) \leq 3$.

Let $\boldsymbol{N} = \{(\boldsymbol{T}, \boldsymbol{I}, \boldsymbol{F}): \boldsymbol{T}, \boldsymbol{I}, \boldsymbol{F} \subseteq [\boldsymbol{0}, \boldsymbol{1}]\}\boldsymbol{n}$ be a neutrosophic evaluation of a mapping of a group of formulas propositional to$\boldsymbol{N}$, and for each sentence $\boldsymbol{p}$:

$$\boldsymbol{v}(\boldsymbol{p}) = (\boldsymbol{T}, \boldsymbol{I}, \boldsymbol{F}) \quad (1)$$

To facilitate the practical application in real-world problems [21], the use of Single-Value neutrosophic Sets (SVNS) was proposed, through which it is likely to use linguistic terms to obtain greater interpretability of the results [22].

Let X be a universe of discourse, an SVNS A over X has the following form [23]:

$$\boldsymbol{A} = \{\langle \boldsymbol{x}, \boldsymbol{u_a}(\boldsymbol{x}), \boldsymbol{r_a}(\boldsymbol{x}), \boldsymbol{v_a}(\boldsymbol{x})\rangle : \boldsymbol{x} \in \boldsymbol{X}\} \quad (2)$$

Where$\boldsymbol{u_a}(\boldsymbol{x}): \boldsymbol{X} \to [\boldsymbol{0}, \boldsymbol{1}], \boldsymbol{r_a}(\boldsymbol{x}): \boldsymbol{X} \to [\boldsymbol{0}, \boldsymbol{1}]$ **and** $\boldsymbol{v_a}(\boldsymbol{x}): \boldsymbol{X} \to [\boldsymbol{0}, \boldsymbol{1}]$with $\boldsymbol{0} \leq \boldsymbol{u_a}(\boldsymbol{x}), \boldsymbol{r_a}(\boldsymbol{x}), \boldsymbol{v_a}(\boldsymbol{x}) \leq \boldsymbol{3}, \forall\, \boldsymbol{x} \in \boldsymbol{X}$

The intervals $\boldsymbol{u_a}(\boldsymbol{x}), \boldsymbol{r_a}(\boldsymbol{x})$ **y** $\boldsymbol{v_a}(\boldsymbol{x})$ denote the true, indeterminate, and false memberships from x in A, respectively [24]. For convenience reasons, a Single-Valued Neutrosophic Number (SVNN) is expressed as A = (a, b, c), where a, b, c∈ [0.1] and $0 \leq a + b + c \leq 3$.

Let A = (a, b, c) be a single-valued neutrosophic number, a score function S related to a single-valued neutrosophic value, based on the truth-membership degree, indeterminacy-membership degree and falsehood membership degree is defined by [25]:

$$\boldsymbol{S}(\boldsymbol{V_i}) = \boldsymbol{2} + \boldsymbol{T_i} - \boldsymbol{F_i} - \boldsymbol{I_i} \quad (3)$$

2.2 Torgerson's mathematical model [26]

There are different techniques for assessing expert consensus, including the Torgerson Mathematical model. With this objectivity is given to the criteria of the experts or other surveyed personnel by converting the ordinal scale into an interval scale. This is convenient because the scales used for the judgments and criteria valued by the experts are ordinal. That is, they can be used to rank (eg. Indispensable, Very Useful, Useful, not useful, etc.) qualitative parameters. The model is based on the following assumptions:

1) Each object (indicator) corresponds to the subjective dimension of a normally distributed random variable, whose mean, *m*, is the scale value of that object. All variances are equal.

2) Each category limit corresponds to the subjective dimension of a normally distributed random variable, whose mean, *t*, is the scale value of that limit. All variables are equal.

3) The random variables that represent both the objects and the limits are independent. One variable cannot contain the values of another.

4) Decision rule: an object belongs to the *k-th* category when its scale value *x* is between the values of the limits of order *k-1* and *k*. This rule defines the border between

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each of the categories assumed for the indicators.

This way, with the model, the ordinal judgments issued by experts are converted into an instrument that expresses their relative position in a continuous range. That is to say, it allows the ordinal scales to be taken to the interval scale (real numbers) and thus knowing the limits in the real values in which each evaluated category is.

2.3 Procedure to follow

For the design of the procedure and to clarify the estimation of the expert in the survey and with the benefits of the single-valued neutrosophic numbers, these intervals will be measured with what is stated in table 1. All this to enable a better understanding and evaluation of the judgments made by the experts. Decision-making usually involves human language or what is commonly referred to as linguistic variables. A linguistic variable simply represents words or terms used in human language. Therefore, this linguistic variable approach is convenient for decision-makers to express their assessments. Ratings of criteria can be expressed by using linguistic variables. Linguistic variables can be transformed into SVNSs as shown in Table 1.

Table1: Linguistic variable and Single Valued Neutrosophic Numbers (SVNNs) [27]

Linguistic variable	SVNNs
Very influential	(0.9; 0.1; 0.1)
Influential	(0.75; 0.25; 0.20)
Moderately influential	(0.50; 0.5; 0.50)
Little influential	(0.35; 0.75; 0.80)
No relationship	(0.10; 0.90; 0.90)

Step 1. Frequency table with single-valued neutrosophic numbers: the indicators to be measured and the measurement scales are established. The data are tabulated according to the frequency and their weighting according to the value of the neutralized neutrosophic number (number of experts who scored in each of the measurement scales by SVNN applying equation 3). For the initial evaluation, the tabulation is carried out with the single-valued neutrosophic numbers according to what is stated in table 1. Then, they are de-neutrosophicated for the rest of the steps using equation 3.

Step 2. Determination of the accumulated frequency: the accumulated frequency is determined for each indicator. Which is the sum of the frequencies up to that data. That is to say, it is the accumulation of sums of frequencies prior to it.

$$F_i = f_1 + f_2 + f_3 + \cdots + f_m \tag{4}$$

Step 3. Determination of the cumulative relative frequency or cumulative probability is obtained by dividing the absolute frequency fi by the total data (M). That is, the cumulative probability matrix is determined with four decimal places, which results from dividing each accumulated by the sample number. It is essential to observe how the category in which probability 1 is repeated will not be necessary to complete the following columns because you already have accumulated the maximum probability.

$$F_i = \frac{f_1}{M} \tag{5}$$

Step 4. Calculation of the break points and scale of the indicators:

1) Determine the inverse standard normal distribution values for each indicator and evaluation using the NORM.INV function in a Microsoft Excel sheet.

2) For the break points, the results of these previous values will be averaged for each one.

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3) For the scales:

   a) Determine the limit value (N): average of the break points, that is why some authors call it an average of average.

   b) Calculate average by indicators (rows).

   c) To determine in which category each of the indicators is found, the limit value N (average of average) is subtracted from the average of the evaluations obtained in each indicator, and this way, its result can be compared with the break points. Thus, if the calculated value is less than or equal to the cut-off point, then the analyzed indicator belongs to this interval.

Step 5.Determination of the level of consensus: the level of consensus (C) is determined by the expression:

$$C = \left[1 - \left(\frac{V_n}{V_t}\right)\right] * 100 \quad (6)$$

Where C: coefficient of agreement, Vn: Negative votes, and Vt: Total votes

Decision rule: If C> 75%, it is considered that there is consensus.

Step 6.Conclusions: it is decided which indicator is selected, measured variable, "No influence", "Low influence", "Medium influence", "High influence" and "Very high influence" for the study.

3. Results

To determine the causal factors of the tendency to the inapplicability of extenuating circumstances, the following bibliography was reviewed: . The following factors were determined from this review:

1) It is believed that its application affects the development of the criminal process
2) The number of mitigating circumstances decreedis considered insufficient, which causes its incompatibility with the prosecuted crime.
3) Lack of preparation of public defenders
4) Misunderstanding of the process for the presentation of extenuating circumstances
5) Failure to observe the conduct of the individual after the crime has been committed
6) Tendency to be used as a means of reducing the penalty for a dangerous person.

Total respondents: 40 experts (lawyers and prosecutors) linked to the Uniandes University

Table 2: Frequency

Factors	(0.9; 0.1; 0.1)	(0.75; 0.25; 0.20)	(0.50; 0.5; 0.50)	(0.35; 0.75; 0.80)	(0.10; 0.90; 0.90)	Punctuation
Damages	20.3	60.9	17.4	17.4	0	116
Insufficient	14.5	20.3	43.5	34.8	2.9	116
Preparation	0	31.9	46.4	37.7	0	116
Misunderstanding	26.1	20.3	52.2	17.4	0	116
Observation	40.6	49.3	17.4	8.7	0	116
Misapplication	0	34.8	52.2	26.1	2.9	116

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Table 3: Cumulative frequency

Factors	(0.9; 0.1; 0.1)	(0.75; 0.25; 0.20)	(0.50; 0.5; 0.50)	(0.35; 0.75; 0.80)	(0.10; 0.90; 0.90)
Damages	20.3	81.2	98.6	116	116
Insufficient	14.5	34.8	78.3	113.1	116
Preparation	0	31.9	78.3	116	116
Misunderstanding	26.1	46.4	98.6	116	116
Observation	40.6	89.9	107.3	116	116
Misapplication	0	34.8	87	113.1	116

Table 4: Relative frequency, cumulative probability

Factors	(0.9; 0.1; 0.1)	(0.75; 0.25; 0.20)	(0.50; 0.5; 0.50)	(0.35; 0.75; 0.80)
Damages	0.1750	0.7000	0.8500	1.0000
Insufficient	0.1250	0.3000	0.6750	0.9750
Preparation	0.0000	0.2750	0.6750	1.0000
Misunderstanding	0.2250	0.4000	0.8500	1.0000
Observation	0.3500	0.7750	0.9250	1.0000
Misapplication	0.0000	0.3000	0.7500	0.9750

Table 5: Calculation of break points

Factors	(0.9; 0.1; 0.1)	(0.75; 0.25; 0.20)	(0.50; 0.5; 0.50)	(0.35; 0.75; 0.80)	Average	N - Avg.
Damages	-0.93	0.52	1.04	3.50	1.03	**-0.52**
Insufficient	-1.15	-0.52	0.45	1.96	0.19	**0.32**
Preparation	-3.50	-0.60	0.45	3.50	-0.04	**0.55**
Incomprehension	-0.76	-0.25	1.04	3.50	0.88	**-0.37**
Observation	-0.39	0.76	1.44	3.50	1.33	**-0.82**
Misapplication	-3.50	-0.52	0.67	1.96	-0.35	**0.86**
Cut-off points	**-1.71**	**-0.10**	**0.85**	**2.99**	**N = 0.51**	

Figure 1: Scales

In general, an 81.59% consensus was obtained, so it can be said that the exercise is valid because there is consensus among the experts consulted. As can be seen in the mathematical exercise, the experts agree that the inapplicability of the mitigating circumstances lies in the prejudices arising from the belief that their application affects the development of the criminal process. Likewise, the misunderstanding of the process for its presentation and the observation of the individual's behavior once the crime has been committed.

In the background, the number of extenuating circumstances decreed, which causes its incompatibility with the crime prosecuted and the training of public defenders, must be improved. So that once this has been achieved, the tendency to be used as a means of reducing the penalty for a dangerous person

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is eliminated once and for all. It should focus on the moment in which these circumstances are introduced into the system and the procedure for this since they determine the alleged dangerousness of the aggressor.

From the training of jurists in general, the assimilation of the concepts must be prioritized because in this way, they will be able to solve problems in professional life from the correct argumentation. The domain of the legal bodies and the possible situations will allow adequate professional performance both in his functions as a lawyer, prosecutor, or judge. Legal professionals should have their knowledge recycled at least once a year as training activities. In this way, it will be a corrective action used to eliminate or mitigate the causes of the problem and not its symptoms.

4. Conclusions

The extenuating circumstances are described in the governing legal bodies of criminal proceedings in Ecuador. However, they have situations that lead to their little or no applicability. So actions need to be taken to mitigate this situation, hence the importance of its study. The objective of the investigation was fulfilled since, according to the experts consulted, the factors with the greatest influence on the existence of the problem could be determined. This mathematical modeling supported by the single value neutrosophic numbers contributed to improving the understanding of the decision-making process. In the same way, potential solutions are proposed to eliminate the problems detected and achieve an adequate performance of the defense attorneys on this issue.

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