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Method for Recommending Custody to Minors based on Parental Responsibility using a Neutrosophic Cognitive Map

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Abstract. Children and adolescents under custody are a phenomenon that occurs daily in the country. Many homes are disorganized because parents abandon their children and leave them in the hands of guardians, who do not take good care of children and adolescents, usually being victims, having consequences in their behavior due to lack of the proper protection of their children parents. These children and adolescents are sometimes victims of violent situations, that is, the rights of children and adolescents are violated. It is necessary to analyze the use of neutrosophic cognitive maps on this problem to determine and characterize the variable factors that affect the custody of minors and the development of childhood and adolescence. So that, with the ranking of the incidence factors, decision-making by the government would be facilitated by defining strategies to mitigate the negative effects coming from custody not conceived under the parents' responsibility and the protection of the rights of childhood and adolescence.

Keywords: custody, effects, neutrosophic cognitive maps.

1 Introduction

Custody during childhood and adolescence is the right that Law confers to the person and property of the minor who is not subject to parental authority and represents him in all acts of civil life [1]. In its essence, custody is an institution of protection. It is sought, within what is humanly possible, that someone fills the void left by the lack of parents, who takes care of the minor, watching over their health and morals, attending to their education, managing their assets; that makes up for their disability, carrying out the acts that the minor cannot perform due to lack of natural aptitude [2].

It is, above all, a highly personal position and, as such, it cannot be transferred between the living or the last will. It cannot be assigned or replaced [3]; Without prejudice to the fact that the guardian is empowered to grant power to carry out certain particular acts, in the same way, that the father of the family can do it, provided that those acts are carried out under his directives and dependencies[4]. It is a public charge; no one can excuse himself or herself from performing it without sufficient cause, the very nature of the institution explains this character.

It is disconcerting to know that when they leave their children under the care of their guardians, they do not even know what role they should play, the care and rights that their wards should receive once they are in their care. It is important to know the reactions that the boy, girl, or adolescent has when separating him or her from their parents may cause psychosocial disorders, communication problems, behaviors associated with delinquency, drug abuse, or withdrawal from the educational system.

These behaviors are born in adolescents due to the psychological state at the time of their parents' departure and have a lot to do with their guardians since, like most of them, they have their occupations, children, and even greater problems than their parents. In turn, the same pupils produce that many of the tutors use their pupils as work instruments and are subject to both physical and psychological abuse as a result of a total or partial disregard of their parents.

A large part of the parents do not even communicate with them, there is a total abandonment of the parents so that some tutors cannot stand the behavior of their pupils, and as has been said, others take advantage of this neglect to use them in illicit situations. Moreover, it is worrying since guardians must replace the care and affection that

parents should share with their children so that they do not feel the absence of their parents [5].

Men have certain duties of solidarity towards their fellow men, all the more so if they are close friends or relatives; succor and help the orphan [6], to the helpless minor, it is a moral obligation, to whose fulfillment no one can refuse without a just cause. Since the position is discerned in the interest of the minor, the state must monitor the proper fulfillment of the duties that the law imposes on the guardian [7]. Thus, among the best-known kinds of custody, we have:

Dative custody, when the father has not appointed a guardian and there are no suitable relatives called by law to the position, or when the persons who exercised it have resigned or were removed, the judge must provide custody, choosing according to his prudent discretion which has to play it [8]. When choosing a guardian, the magistrate's decision must be based primarily on the interests of the child. Therefore, it is prudent to consider the following circumstances:

- the religious confession of the guardianship, which does not mean that the diversity of cults is an insurmountable obstacle, but simply that, taking into account the peculiarities, a conflict of conscience would result, more generally, harm to the minor;
- the relationship;
- the circumstance of having cared for the minor [9];
- the opinion of the minor, if he is close to the age of majority;
- the offer to perform the position free of charge;
- The parents' wish reliably expressed, even if not with the formalities established for testamentary custody [10].

To achieve a greater understanding to provide notions for prior knowledge that allows analysis, the different types of custody are exposed:

- Legitimate custody: it is called legitimate custody the one that is discerned by a preference established by law. It has a subsidiary nature since the legal appeal only applies to the case that the father has not appointed another guardian. It is assumed that no one like the parents can indicate the person who best takes care of the child; but failing that, better performance is presumed on the part of grandparents and siblings, who will normally put more love and dedication than a stranger will.
- Testamentary custody: it is called testamentary custody when it originates in the last will provision of the father or mother [11].
- Custody or testamentary curatorship: is constituted by a testamentary act, and the choice corresponds to the parents since they are the ones who want the assets to be administered in the best way, after their days, by a person of her confidence.
- Custody or legal custody, this kind of legal guardianship is the one that is conferred by law on the relatives or spouse of the ward and it is resorted to, in general terms, when there is no testamentary guardian.
- Dative custody or curatorship, the dative guardianship is the one conferred by the magistrate, proceeding in the absence of another in such a way that it will be resorted to when there is no testamentary guardian, or spouse or relatives to whom the legitimate guardianship corresponds [12].

Today there is a lack of understanding regarding due process in these types of situations. Many times there are analyses focused on the custody of the children even when their parents live and due to elementary conditions they cannot take care of their children, they resort to custody (figure 1) that are carried out in the wrong way. That is why this work is focused on the custody of minors based on the responsibility of the parents.

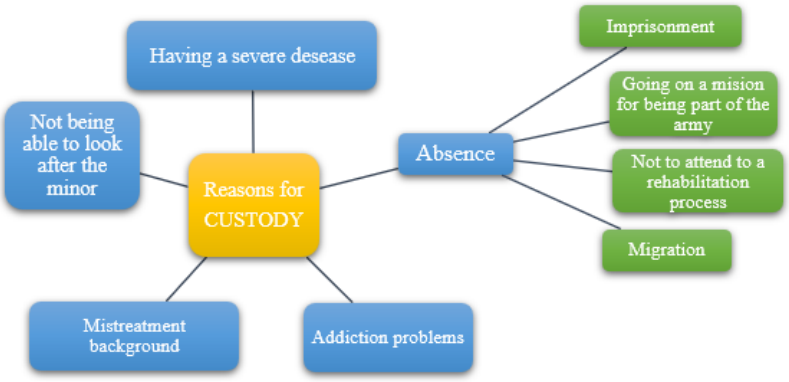

Figure 1: Conditioning factors of the custody process. Source: own elaboration

The main objective of this research is to analyze the variable factors affecting the custody of minors and the development of childhood and adolescence. Thus, by prioritizing the incidence factors, decision-making by the government will be facilitated, outlining strategies to mitigate the negative effects radiated by custody not conceived under the responsibility of the parents and in order to protect the rights of children and adolescents. To comply with the above, the following specific objectives are proposed:

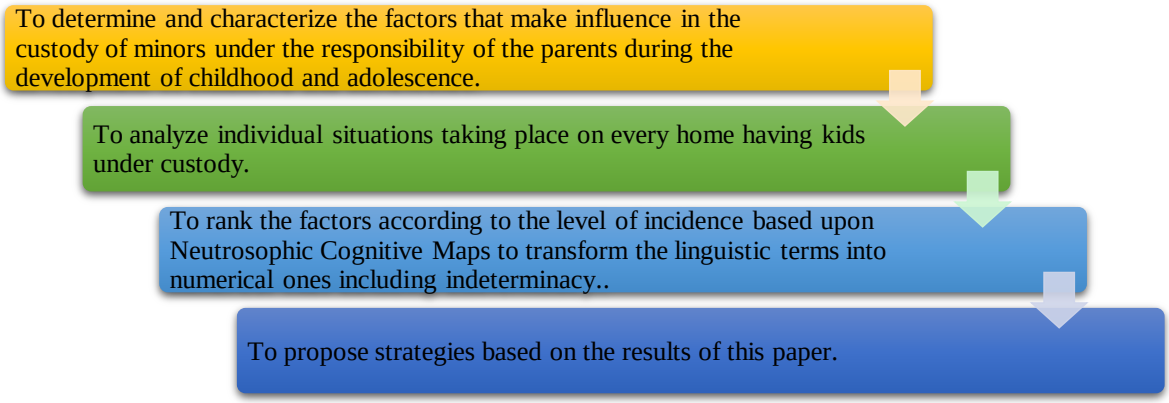

Figure 2: Specific objectives to develop during the investigation. Source: own elaboration.

After a review of the bibliography and consultation with several authors, it was decided that, due to its versatility in the investigation of factors, the neutrosophic cognitive maps from the theory of Neutrosophy proposed by Florentin Smarandache would be chosen for the treatment of the neutralities, which generalizes theories and has applications in many fields. In this case, sharp and fuzzy sets are where the indeterminacies have support. Neutrosophy is a valuable theory that is increasing its inclusion, enriching the possibilities of analysis, mainly due to two issues: first, the addition of the notion of indeterminacy and, secondly, the possibility of calculating using linguistic terms [22].

The decision for applying neutrosophic cognitive maps for this analysis lies in the fact that this represents knowledge as a directed graph. Each vertex of the graph represents a concept and each edge causal relationship between the concepts is represented by the vertices connected. Additionally, each edge is associated with a real value in the interval [-1,1], where a negative value means that there is an inverse relationship between the concepts and a positive value means that the relationship is direct. The value in modulus of the value measures the strength between the relationships. This method has been used successfully in social studies.

This technique will be used to represent the causal relationships among the variables in the relationship between guardian and minor in custody in Ecuador, in addition to classifying each of them as a transmitter, which is an impulse component, a receiver that is impacted, and an ordinary one that is an intermediate component. Hierarchizing the factors by their level of incidence based on the neutrosophic cognitive maps will allow indeterminacy to be treated in the expert consultation by transforming fuzzy linguistic terms into neutrosophic mathematical terms.

2 Materials and methods

During the development of this research, we used the quantitative methodology because it allows us to accurately analyze with numerical percentages and make an assessment and establish statistical data to collect the indices. In the same way, information was collected from different books of various jurists in Ecuador, comparative law, laws currently in force. It was possible to state in the present investigation that it was carried out concerning the subject of study, it has been possible to certify that there is not an adequate database of specific and organized data on this problem.

In addition, the method of documentary research, bibliographic, field and observational research, inductive/deductive method was used through results directed to different institutions to collect information, with respective tools of results that allow to analyze and compare them with the current norm in force to end with a conclusion according to law. After analyzing the previous speech, it was necessary to apply the following theoretical methods by the authors to prepare the document:

- Analysis and Synthesis of the information obtained from literature review, both international and national, of the specialized documentation, as well as the experience of actors consulted to develop logical and valid

conclusions, as well as a set of premises and/or positions generated by relevant participants within the social system.

- ❖ Systemic - structural for the development of the analysis through the decomposition of the elements that comprise it.
- ❖ Hermeneutic to carry out a comparative interpretation of the legislation applicable to the subject in question.

2.1 Neutrosophic cognitive maps

Starting from the previous elements, the use of Neutrosophic Cognitive Maps (NCMs) is proposed considering the advantages that this technique offers, in terms of interpretability, scalability, aggregation of knowledge, dynamism, and its ability to represent feedback and indeterminacy in relationships [13]. NCMs were introduced by[14] in 2003. NCMs are an integration of the Fuzzy Cognitive Maps (NCMs) introduced by Kosko in 1986 and the Neutrosophic Sets (NCMs) introduced by Smarandache in 1995 [15]. This technique overcomes the inability of traditional NCMs to represent indeterminacy. The inclusion of indeterminacy establishes that neutrality and ignorance are also forms of uncertainty.[15] exposes that DCMs 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. Firstly, it exposes the original definition of neutrosophic logic as shown in [16-37].

Definition 1. Let N = {(T, I, F): T, I, F∈ [0,1]} C [38]be a neutrosophic set of evaluation. v: P→N is a mapping of a group of propositional formulas into N, i.e., each sentence p∈ 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.

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

Henceforth, the neutrosophic logic is a generalization of fuzzy logic, based on the concept of Neutrosophy according to [37, 39].

Definition 2. (See[38, 40] Let K be the ring of real numbers. The ring generated by K∪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∈, then kI = kI, 0I = 0. The neutrosophic ring is denoted by K (I), which is generated by K∪I, ie, K (I) = <K∪I>, where <K∪I> denotes the ring generated by K and I.

Definition 3. A neutrosophic matrix is a matrix A = [aij] ij i = 1, 2,…, m and j = 1, 2,…, n; m, n≥1, such that each aij∈K (I), where K (I) is a neutrosophic ring, see [41].

Let us observe that an element of the matrix could have the form a + bI, where "a" and "b" are real numbers, whereas I is the indeterminacy factor. The usual operations of neutrosophic matrices can be extended from 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 [16, 31]. The neutrosophic adjacency matrix is an extension of the classical adjacency matrix in graph theory. aij = 0 means nodes i and j are not connected, aij = 1 means that these nodes are connected and aij = I, which means the connection is indeterminate. Fuzzy set theory does not use such kind of notions.

On the other hand, if the indetermination is introduced in a cognitive map as it is referred to in [42], this cognitive map is called a neutrosophic cognitive map, which is useful in representing and anlysis of causal knowledge [39, 43]. It is formally defined in Definition 4.

Definition 4. A Neutrosophic Cognitive Map (NCM) is a neutrosophic directed graph with concepts, as nodes and causalities or indeterminate as edges. It represents the causal relationship between concepts.

The measures described below are used in the proposed model, based on the absolute values of the adjacency matrix [42]:

- ❖ 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.

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

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

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

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

$$td(v_i) = od(v_i) + id(v_i) \quad (4)$$

The static analysis is applied using the adjacency matrix, considering the absolute value of the weights [31]. Static analysis in Neutrosophic Cognitive Maps (NCM) [43], initially contains the neutrosophic number of the form (a + bI, where I = indetermination) [44]. Then, it requires a process of de-neutrosophication as proposed in[42], where I ∈ [0, 1].

Finally, we work with the average of the extreme values, which is calculated using Equation 5, which is useful to obtain a single value for connections [45]. This value contributes to the identification of the characteristics to be attended

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

Then,

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

3 Case study

Custody of minors occurs when the court orders a person who is not the parent of a minor to:

- Have custody of the minor; or
- Manage the minor's assets (called “estate”); or
- Both.

The information in this section refers to testamentary custody. These cases are started by the person who wants to be the guardian or by another relative who asks the court to appoint a guardian[46]. If the juvenile dependency court awarded custody of a minor to someone other than the parent, the information provided in this section does not apply to this case. Testamentary custody of the person is established when a minor is living with an adult other than the parent, and the adult needs a court order to make decisions on behalf of the minor. In general, such kinds of custody are for minors under 18 years of age. In the custody of minors, the following is established:

- Parents retain their parental rights. They can have reasonable contact with the minor.
- The court may end custody if the parents regain the ability to care for their child.
- The court may supervise guardians.

The guardian is also responsible for the supervision of the minor and may be liable for any intentional harm caused by the minor. Sometimes a guardian of a person is needed when parents cannot raise a minor, regardless of how much they love him[47]. The court will consider the child's best interest to ensure that the child is raised in a safe, stable, and nurturing environment. A legal guardian can take care of a minor when his parents are unable to do so.

4 Results

When analyzing the information regarding custody under the responsibility of parents to leave a guardian to represent them for their children when they cannot respond to the basic needs for their development in the stages of childhood and adolescence. The analysis determined two situations:

- Situation I: Analysis of the factors in custody focused on children and adolescents
  - Most of the boys, girls and adolescents live mostly abandoned, not living with their parents suffer psychological disorders due to abandonment.
  - The forgetfulness of their parents affects the behavior of children and adolescents.
  - Most of the children live under the custody of people who are not family.
  - Lack of care and protection directly impacts the normal development of children and adolescents since their parents rarely communicate with them.
  - They have no one to guide them or guide them in their schoolwork, children and young people feel alone because they do not have a person by their side to turn to in case of proper guidance
  - The lack of parents in the home directly influences school performance
  - Longing to live with parents, because the people who care for them cannot replace the parents
  - Abandonment in the homes of curators and tutors who do not receive money for the needs of the children, which constitutes even more of a problem when there is no money involved.
  - They are prone to suffer from child abuse as it affects the self-esteem of the boys and when they are punished, they have sequels that come to constitute notorious problems over the years.

❖ Situation II: Analysis of the factors in custody focused on guardians

- There is ignorance in knowing the meaning of what a tutor or curator is, this indicates that briefly, they know its meaning empirically and importantly so that these adolescents can lead a full life and in some way replace the absence of their parents
- Most parents leave their children in the hands of relatives to make up for their lack in some way.
- The lack of knowledge of the functions when taking care of minors and adolescents means that most of them suffer violations of their rights by their guardians and other people and institutions with which they have contact.
- It is difficult to provide the necessary care and attention to children under custody.
- Most tutors lack the aptitudes and attitudes to perform and don't know how to guide the pupil correctly
- The abuse of those under their care is not reported, mostly children and adolescents who do not have constant communication with their parents

Once the state of the elements under analysis has been analyzed, we proceed to the extraction of potential factors applying the following process:

Situation I: Custody (point of view of children and adolescents)
A. Psychological state
B. Physical state
C. School development
D. Poor communication (between parent and ward)
E. Life conditions
F. Economic environment

Situation II: Custody (guardian's point of view)
G. Economic conditions
H. Communication (between tutor and ward)
I. Life conditions
J. Family atmosphere
K. Legal scenario (rights and obligations of children and adolescents in custody)
L. Tutor training (attitudes and skills of the tutor to perform and to know how to guide his pupil)

When analyzing the negative criteria obtained from the extraction of the information, we decided to evaluate using the NCMs method, which are the strategies with the potential to mitigate the negative effects. These factors called variables will be denoted by alphanumeric codes (a1, b1, c1, d1, f1, g1) for situation I (figure 2) and (g1, h1, i1, j1, k1, l1) for situation II (figure 3), following the previous order in the table. A group of experts evaluates the causal relationships between the six previous variables with neutrosophic numbers; an average of the evaluations of the experts was used. From them, an adjacency matrix was obtained and the graph that represents it:

Situation I

$$N(E) = \begin{bmatrix} 0 & 1 & 1 & 0.9 & 1 & I \\ 1 & 0 & 0 & 0.3 & I & 0 \\ 0.2 & 0.3 & 0 & 0.2 & I & 0 \\ 0.9 & 0.5 & 0 & 0 & 1 & 0.9 \\ 1 & 1 & 0.8 & I & 0 & I \\ I & 0 & 0.2 & 0.9 & I & 0 \end{bmatrix}$$

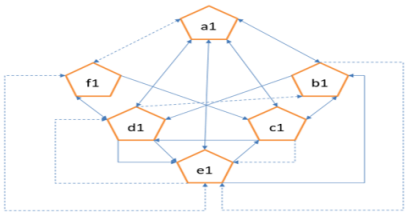

Figure 3: Neutrosophic, neutrosophied adjacency matrix and the means of the extreme values corresponding to the NCM.

$$N(E) = \begin{bmatrix} 0 & 1 & 1 & 0.9 & 1 & I \\ 1 & 0 & 0 & 0.3 & I & 0 \\ 0.2 & 0.3 & 0 & 0.2 & I & 0 \\ 0.9 & 0.5 & 0 & 0 & 1 & 0.9 \\ 1 & 1 & 0.8 & I & 0 & I \\ I & 0 & 0.2 & 0.9 & I & 0 \end{bmatrix} \quad E = \begin{bmatrix} 0 & 1 & 1 & 0.9 & 1 & 0.5 \\ 1 & 0 & 0 & 0.3 & 0.5 & 0 \\ 0.2 & 0.3 & 0 & 0.2 & 0.5 & 0 \\ 0.9 & 0.5 & 0 & 0 & 1 & 0.9 \\ 1 & 1 & 0.8 & 0.5 & 0 & 0.5 \\ 0.5 & 0 & 0.2 & 0.9 & 0.5 & 0 \end{bmatrix}$$

	td
a1	1,81
e1	1,65
d1	1,38
b1	1,11
f1	0,90
c1	0,79

According to the above-explained, we can reach the following partial conclusion:

- When a1 is activated, all other nodes are activated, which means that the psychological state will cause an influence on the other problems identified in the other vertices, it will have a positive influence due to the causal relationship with the positive indices (if p1 increases then e1, d1, b1, f1, c1 will increase in the same way).
- The relationships with a1 and the rest of the nodes are bidirectional; therefore, the causal relationship is confirmed in both directions and magnitude.
- If a1 is activated, it can be verified that there is strong causal relationship also with the rest of the nodes, but not in both directions, unlike c1.
- A relationship of indeterminacy is observed from f1 to e1, e1 to b1.

Result: The order of importance of the factors will be as follows a_1≻e_1≻d_1≻b_1≻f_1≻c1
Priority factor to be analyzed: Mitigate the possible psychological effects of the minor under custody.

Situation II

$$N(E) = \begin{bmatrix} 0 & 0 & 1 & I & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 1 \\ 1 & 0 & 0 & 1 & 0.2 & 1 \\ I & 1 & 1 & 0 & 1 & I \\ 0 & 0 & 0.8 & 1 & 0 & 1 \\ 0 & 1 & 0.2 & 1 & 1 & 0 \end{bmatrix}$$

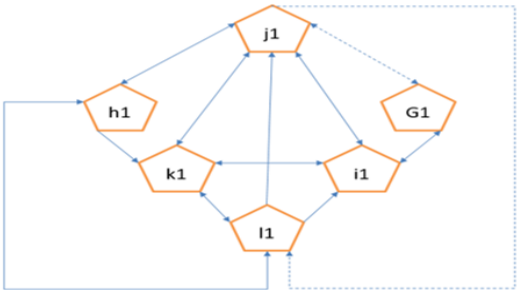

Figure 4: Neutrosophic, de-neutrosophied adjacency matrix and the means of the extreme values corresponding to the NCM.

$$N(E) = \begin{bmatrix} 0 & 0 & 1 & I & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 1 \\ 1 & 0 & 0 & 1 & 0.2 & 1 \\ I & 1 & 1 & 0 & 1 & I \\ 0 & 0 & 0.8 & 1 & 0 & 1 \\ 0 & 1 & 0.2 & 1 & 1 & 0 \end{bmatrix} \quad E = \begin{bmatrix} 0 & 0 & 1 & 0.5 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 1 \\ 1 & 0 & 0 & 1 & 0.2 & 1 \\ 0.5 & 1 & 1 & 0 & 1 & 0.5 \\ 0 & 0 & 0.8 & 1 & 0 & 1 \\ 0 & 1 & 0.2 & 1 & 1 & 0 \end{bmatrix}$$

	td
j1	1,88
k1	1,33
l1	1,26
i1	1,15
h1	1,11
g1	0,66

Based on the above-mentioned, we can reach the following partial conclusion:

- When j1 is activated, all other nodes are activated, which means that an ideal family environment will collaborate to a state of comfort in the child. It will have an optimistic influence due to the causal relationship with positive indices (if j1 increases then k1, l1, i1, h1, g1 will increase in the same way).
- The relationships with p1 and nodes h1, k1, i1 are bidirectional, therefore, the causal relationship is confirmed in both directions and magnitude, except from node l1 to j1
- If j1 is activated, it can be verified that there is a strong causal relationship also with the rest of the nodes, but not in both directions, unlike l1.
- A relationship of indeterminacy is observed from h1 to l1 and from j1 to l1.

Result: The order of importance of the factors will be the following j_1≻k_1≻l_1≻i_1≻h_1≻g_1
Priority factor to analyze: Create a pleasant family environment that contributes to the child or adolescent's development in the absence of their parents.

5. Discussion of the case

Strategies to consider:

- From the minor's perspective (Situation I), the judges are focused on mitigating the psychological effects that may arise from the custody provided.
- From the guardian's perspective (situation II) an adequate family environment must be created to meet the necessary conditions in accordance with the Childhood and Adolescence Code.

Therefore, as a strategy to consider:

- No.1: Create a family environment, as a fundamental space conditioned to provide all the warmth of home to mitigate possible psychological disorders generated by the effect of the abandonment of their parents.

- ❖ No.2: Supervise by the competent judicial entities that the family environment and the psychological state of the minor are in harmony and that it positively influences the normal development of children and adolescents, to make up for the lack of their parents.

Conclusions

After developing this research, the following conclusions were reached:

- The indeterminacy is incorporated into modeling the causal relationships between the factors, where neutrosophic science is an active part of decision-making. It is mainly because it is a very subjective process where uncertainty reaches all decision levels. That is why neutrosophic cognitive maps are a useful tool for the analysis of this type of social problem.
- Children under custody are prone to child abuse, which affects their self-esteem. These, when punished, have sequels that constitute notorious problems that are transferred from year to year and can lead to unpleasant outcomes if they are not appropriately treated.
- Most of the children under custody live abandoned, which causes them to suffer psychological disorders in longing for their parents. That is why the tutors and the judges agree that an ideal family environment must be created so that the minor feel in a state of comfort and security as a result of due process.
- Most children do not remember their parents; this is because they were left under the care of other people at an early age, which directly affects the behavior of children and adolescents. This verifies that the priority factor in both situations is focused on mitigating possible disorders in the child's psychological state and improving the comfort, safety, and warmth provided by a healthy family environment in childhood and adolescence.

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