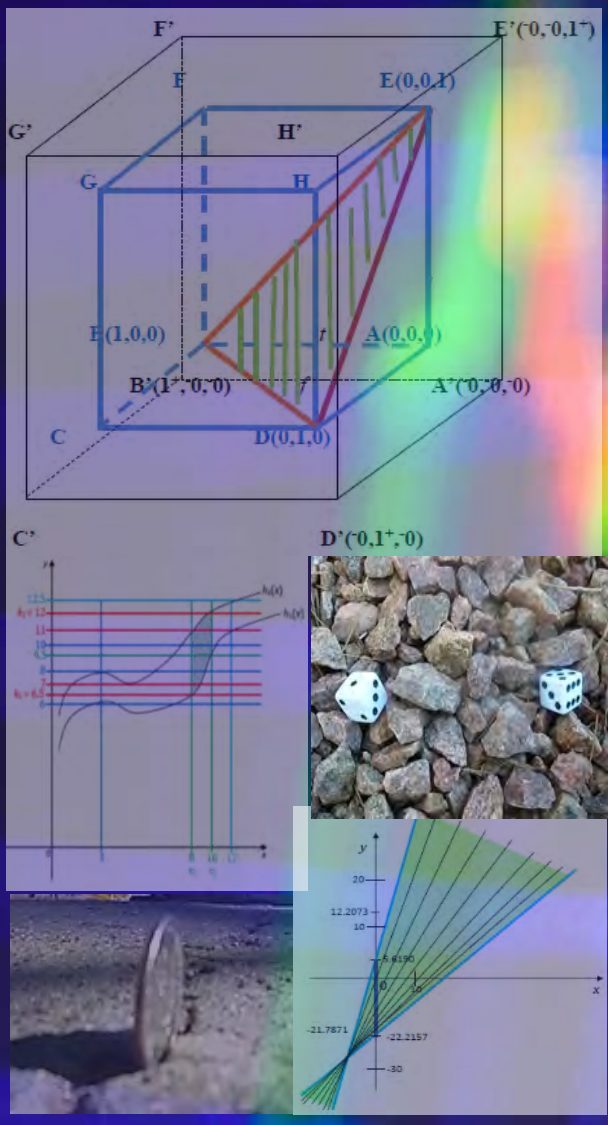
ISBN9781599736204

Neutrosophic Sets and Systems

Book Series, Vol. 26, 2019



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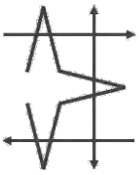
ISBN 978-1-59973-622-8

ISBN 978-1-59973-622-8



Neutrosophic Science
Internation al Association (NSIA)

Neutrosophic Sets and Systems

An International Book Series in Information Science and Engineering

University of New Mexico
United States

ISBN 978-1-59973-622-8

University of New Mexico 

Neutrosophic Sets and Systems

An International Book Series in Information Science and Engineering

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*"*Neutrosophic Sets and Systems*"* has been created for publications on advanced studies in neutrosophy, neutrosophic set, neutrosophic logic, neutrosophic probability, neutrosophic statistics that started in 1995 and their applications in any field, such as the neutrosophic structures developed in algebra, geometry, topology, etc.

The submitted papers should be professional, in good English, containing a brief review of a problem and obtained results.

Neutrosophy is a new branch of philosophy that studies the origin, nature, and scope of neutralities, as well as their interactions with different ideational spectra.

This theory considers every notion or idea <A> together with its opposite or negation <antiA> and with their spectrum of neutralities <neutA> in between them (i.e. notions or ideas supporting neither <A> nor <antiA>). The <neutA> and <antiA> ideas together are referred to as <nonA>.

Neutrosophy is a generalization of Hegel's dialectics (the last one is based on <A> and <antiA> only).

According to this theory every idea <A> tends to be neutralized and balanced by <antiA> and <nonA> ideas - as a state of equilibrium.

In a classical way <A>, <neutA>, <antiA> are disjoint two by two. But, since in many cases the borders between notions are vague, imprecise, Sorites, it is possible that <A>, <neutA>, <antiA> (and <nonA> of course) have common parts two by two, or even all three of them as well.

Neutrosophic Set and *Neutrosophic Logic* are generalizations of the fuzzy set and respectively fuzzy logic (especially of intuitionistic fuzzy set and respectively intuitionistic fuzzy logic). In neutrosophic logic a proposition has a degree of truth (T), a degree of indeterminacy (I), and a degree of falsity (F), where T, I, F are standard or non-standard subsets of $]^-0,1^+[$.

Neutrosophic Probability is a generalization of the classical probability and imprecise probability.

Neutrosophic Statistics is a generalization of the classical statistics.

What distinguishes the neutrosophics from other fields is the <neutA>, which means neither <A> nor <antiA>.

<neutA>, which of course depends on <A>, can be indeterminacy, neutrality, tie game, unknown, contradiction, igno- rance, imprecision, etc.

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The Educational Publisher Inc.
1313 Chesapeake Ave. Columbus, Ohio 43212, USA

ISBN 978-1-59973-622-8

Editors-in-Chief

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ISBN 978-1-59973-622-8

NSS

ISBN 978-1-59973-622-8

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ISBN 978-1-59973-622-8

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Contents

Address:
"Neutrosophic Sets and Systems"
(An International Book Series in Information Science and Engineering)
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705 Gurley Avenue Gallup, NM 87301, USA
E-mail: smarand@unm.edu
Home page: http://fs.unm.edu/NSS

Neutrosophic Triplet Group (revisited)

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Abstract. We have introduced for the first time the notion of neutrosophic triplet since 2014, which has the form (x, neut(x), anti(x)) with respect to a given binary well-defined law, where neut(x) is the neutral of x, and anti(x) is the opposite of x. Then we define the neutrosophic triplet group (2016), prove several theorems about it, and give some examples. This paper is an improvement and a development of our 2016 published paper.
Groups are the most fundamental and rich algebraic structure with respect to some binary operation in the study of algebra. In this paper, for the first time, we introduced the notion of neutrosophic triplet, which is a collection of three elements that satisfy certain axioms with respect to a binary operation. These neutrosophic triplets highly depend on the defined binary operation. Further, in this paper, we used these neutrosophic triplets to introduce the innovative notion of neutrosophic triplet group, which is a completely different from the classical group in the structural properties. A big advantage of neutrosophic triplet is that it gives a new group (neutrosophic triplet group) structure to those algebraic structures, which are not group with respect to some binary operation in the classical group theory. In neutrosophic triplet group, we apply the fundamental law of Neutrosophy that for an idea A, we have the neutral of A denoted as neut(a) and the opposite of A dented as anti(A) to capture this beautiful picture of neutrosophic triplet group in algebraic structures. We also studied some interesting properties of this newly born structure. We further defined neutro-homomorphisms for neutrosophic triplet groups. A neutro-homomorphism is the generalization of the classical homomorphism with two extra conditions. As a further generalization, we gave rise to a new field or research called Neutrosophic Triplet Structures (such as neutrosophic triplet ring, neutrosophic triplet field, neutrosophic triplet vector space, etc.). In the end, we gave main distinctions and comparison of neutrosophic triplet group with the Molaei's generalized group as well as the possible application areas of the neutrosophic triplet groups. In this paper we improve our [13] results on neutrosophic triplet groups.

Keywords: Groups, homomorphism, neutrosophic triplet, neutrosophic triplet group, neutro-homomorphism t.

1 Introduction

Neutrosophy is a new branch of philosophy that studies the nature, origin and scope of neutralities as well as their interaction with ideational spectra. Florentin Smarandache [8] in 1995, first introduced the concept of neutrosophic logic and neutrosophic set where each proposition in neutrosophic logic is approximated to have the percentage of truth in a subset T, the percentage of indeterminacy in a subset I, and the percentage of falsity in a subset F so that this neutrosophic logic is called an extension of fuzzy logic especially of the intuitionistic fuzzy logic. In fact neutrosophic set is the generalization of classical sets[9], fuzzy set[12], intuitionistic fuzzy set[1,9], and interval valued fuzzy set[9] etc. This mathematical tool is used to handle problems consisting uncertainty, imprecision, indeterminacy, inconsistency, incompleteness and falsity. By utilizing the idea of neutrosophic theory, Vasantha Kandasamy and Florentin Smarandache studied neutrosophic algebraic structures in [4,5,6] by inserting an indeterminate element "I" in the algebraic structure and then combine "I" with each element of the structure with respect to corresponding binary operation *. They call it neutrosophic number { $a + bI$, with a, b real numbers, and I = literal indeterminacy, $I^2 = I$ } and the generated algebraic structure is then termed as neutrosophic algebraic structure. They further study several neutrosophic algebraic structures such as neutrosophic fields, neutrosophic vector spaces, neutrosophic groups, neutrosophic bigroups, neutrosophic N-groups, neutrosophic semigroups, neutrosophic bisemigroups, neutrosophic N-semigroup, neutrosophic loops, neutrosophic biloops, neutrosophic N-loop, neutrosophic groupoids, and neutrosophic bigroupoids and so on.

Groups [2,3,11] are very important in algebraic structures because they play the role of a backbone in almost all algebraic structures theory. Groups are thought as old algebra due to its rich structure than any other notion. In many algebraic structures, groups provide concrete foundation such as, rings, fields, vector spaces, etc. Groups are also important in many other areas like physics, chemistry, combinatorics, biology etc. to study the symmetries and other behavior among their elements. The most important aspect of a group is group action. There are many types of groups, such as: permutation groups, matrix groups, transformation groups, Lie-groups etc. that are highly used as a practical perspective in our daily life. Generalized groups [7] are important in this aspect.

In this paper, for the first time, we introduced the idea of neutrosophic triplet. The newly born neutrosophic triplets are highly dependable on the proposed binary operation. These neutrosophic triplets have been discussed by Smarandache and Ali in Physics [10]. Moreover, we used these neutrosophic triplets to introduce neutrosophic triplet group, which is different from the classical group both in structural and foundational properties from all aspects. Furthermore, we gave some interesting and fundamental properties and notions with illustrative examples. We also introduced a new type of homomorphism called as neutro-homomorphism, which is in fact a generalization of the classical homomorphism under some conditions. We also study neutro-homomorphism for neutrosophic triplet groups. The rest of the paper is organized as follows. After the literature review in section 1, we introduced neutrosophic triplets in section 2. Section 3 is dedicated to the introduction of neutrosophic triplet groups with some of its interesting properties. In section 4, we developed neutro-homomorphism and in section 5, we gave distinction and comparison of neutrosophic triplet group with the Molaei's generalized group. We also draw a brief sketch of the possible applications of neutrosophic triplet group in other research areas. Conclusion is given in section 6.

2 Neutrosophic Triplet

Remark 2.1. All below theorems and propositions in a Neutrosophic Triplet Set (NTS) and Neutrosophic Triplet Group (NTG) are true when the multipliers are non-zero and cancellable multipliers.

An element $a \in (S, *)$, where * is a binary law, *is cancellable to the left* if:

$\forall\, b, c \in S$, from $a*b = a*c$ one gets only $b = c$.

The element a is *cancellable to the right* if:

$\forall\, b, c \in S$, from $b*a = c*a$ one gets only $b = c$.

And, the element a is *cancellable (in general)* if the element a is both cancelable to the left and to the right.

Definition 2.1.1. Let N be a set together with a binary operation *. Then N is called a *neutrosophic triplet set* if for any $a \in N$, there is a neutral of "a" called $neut(a)$, different from the classical algebraic unitary element, and an opposite of "a" called $anti(a)$, with $neut(a)$ and $anti(a)$ belonging to N, such that:

$$a * neut(a) = neut(a) * a = a$$

and

$$a * anti(a) = anti(a) * a =$$

The elements a, $neut(a)$, and $anti(a)$ are collectively called as neutrosophic triplet and we denote it by (a, $neut(a)$, $anti(a)$). By $neut(a)$, we mean $neutral$ of a and apparently, a is just the first coordinate of a neutrosophic triplet and not a neutrosophic triplet.

For the same element a in N, there may be more neutrals to it *neut(a)* and more opposites of it *anti(a).*

Remark 2.2

If a well-defined binary law * on the set N has a classical algebraic unitary element e in N, then no other triplet of the form (e, b, c) can be formed, except the (e, e, e), i.e. when $b = c = e$, which is not accepted as neutrosophic triplet.

Consequently, the set $(N, *)$ with a classical unitary element cannot be a neutrosophic triplet set.

Remark 2.2.

It is important that there are at least two different neutral elements with respect to all set elements into a neutrosophic triplet set.

Definition 2.1.3. A *Zero Neutrosophic Triplet* on the neutrosophic triplet set N, is a neutrosophic triplet of the form $(0, 0, a)$, where $0, a \in N$ {of course, the triplet $(0, 0, a)$ must satisfy the axioms of the neutrosophic triplet}.

Example 2.1.3.1. Let N=be a set with respect to multiplication $\times$ modulo 10 in $a \in N, 6 \times a = a \times 6 = a(mod\ 10)$.
It should be remarked, to this example, that *6* is a classical algebraic unitary element on *N*, with respect to the multiplication $\times$ modulo *10*, because for any $a \in N$, $6 \times a = a \times 6 = a\ (mod\ 10)$.
But *6* cannot be a neutral for the element $0 \in N$, because *(0, 6, ?)* cannot form a neutrosophic triplet since there is no *anti(0)* such that:
$0 \times anti(0) = anti(0) \times 0 = 6$.
Therefore, the neutrosophic triplets of *0* [called *Zero Neutrosophic Triplets*] are
(0, 0, 0), (0, 0, 2), (0, 0, 4), (0, 0, 6), (0, 0, 8).
N is not a neutrosophic triplet set since, except element *0*, the other elements *2, 4, 6,* and *8* do not have neutral elements different from the classical unitary element *6.*
Theorem 2.1. Let *N* be a set endowed with the binary law *, which is well-defined and has the classical algebraic unitary element $e \in N$,

$$\forall x \in N,\ e * x = x * e = x.$$

If *(e, b, c)* is a neutrosophic triplet, with $b, c \in N$, then $b = c = e$.
{In other words, if a set *N* has a classical algebraic unitary element *e,* with respect to the binary well-defined law *, then the only neutrosophic triplet of *e* is *(e, e, e),* which is mutually called trivial neutrosophic triplet, the only triplet that makes exception from the definition of neutrosophic triplets.}
Proof.
Let *(e, b, c)* be a neutrosophic triplet. Since *neut(e) = b*, one has:
*e*neut(e) = neut(e)*e = e*,
but *e*b = b* and *b*e = b* too (since *e* is the classical algebraic unitary element on the set *N*),
whence $b = e$.
And, because *anti(e) = c*, one has:
*e*c = c*e = e*,
but *e*c = c* and *c*e = c* too (since *e* is the classical algebraic unitary element on the set *N*),
whence $c = e$.
Therefore, the only triplet of the classical algebraic unitary (identity) element is
(e, e, e), but it cannot be considered a neutrosophic triplet.
Definition 2.2: The element b in (N, *) is the second component , denoted as $neut(\cdot)$ of a neutrosophic triplet, if there exist other elements a and c in N such that $a * b = b * a = a$ and $a * c = c * a = b$. The formed neutrosophic triplet is (a, b, c) .
Definition 2.3: The element c in $(N,*)$ is the third component, denoted as $neut(\cdot)$, of a neutrosophic triplet, if there exist other elements a and c in N such that $a * b = b * a = a$ and $a * c = c * a = b$. The formed neutrosophic triplet is (a, b, c).
Example 2.2. Consider Z under multiplication modulo 6 , where

$$Z_6 = \{0,1,2,3,4,5\}$$

The classical unitary element is *e = 1*.
Then 2 gives rise to a neutrosophic triplet because $neut(2) = 4$, as $2 \times 4 = 8$. Also $anti(2) = 2$ because $2 \times 4 = 4$. Thus $(2,4,2)$ is a neutrosophic triplet. Similarly 4 gives rise to a neutrosophic triplet because $neut(4) = anti(4) = 4$. So $(4,4,4)$ is a neutrosophic triplet. 3 has two neutrals, $neut(3) = \{3, 5\}$, and forms one neutrosophic triplet (3, 3, 3), but 3 does not give rise to a neutrosophic triplet for $neut(3) = 5$ since $anti(3)$ does not exist in Z_6 for this neutral,
5 has no *neut(5)* so no neutrosophic triplet related to *5*, and last but not the least 0 gives rise to a trivial neutrosophic triplet as $neut(0) = anti(0) = 0$. The zero neutrosophic triplets are denoted by(0,0,0), (0, 0, 1), (0, 0, 2), (0, 0, 3), (0, 0, 4), (0, 0, 5).
Z_6 is not a neutrosophic set, since *1* and *5* have no corresponding neutrosophic triplets, but
$M_6 = \{0, 2, 3, 4\} \subset Z_6$ *is a commutative neutrosophic group* [whose definition will be provided below].

Theorem 2.3. If $(a, neut(a), anti(0))$ form a neutrosophic triplet, then

1. $(anti(a), neut(a), a)$ also form a neutrosophic triplet, and similarly
2. $(neut(a), neut(a), neut(a))$ form a neutrosophic triplet.

Proof. We prove both 1 and 2.
1. Of course, $anti(a) * a = neut(a)$.

We need to prove that:

$$anti(a) * neut(a) = anti(a)$$

Multiply by a to the left and we get:
$a * anti(a) * neut(a) = a * anti(a)$ Or
$[a * anti(a)] * neut(a) = neut(a)$Or

$$neut(a) * neut(a) = neut(a)$$

Again multiply by a to the left and we get:

$$a * neut(a) * neut(a) = a * neut(a)$$

Or

$$[a * neut(a)] * neut(a) = a$$

Or

$$a * neut(a) = a$$

2. To show that $(neut(a), neut(a), neut(a))$ is a neutrosophic triplet, it results from the fact that

$$neut(a) * neut(a) = neut(a).$$

3 Neutrosophic Triplet Group

Definition 3.1: Let (N,*) be a neutrosophic triplet set (which includes the trivial neutrosophic triplet too, if any). Then N is called a neutrosophic triplet group, if the following conditions are satisfied.
1) If (N,*) is well-defined, i.e. for any $a, b \in N$, one has $a * b \in N$.
2) If (N,*) is associative, i.e. (a*b)*c= a*(b*c) for all $a, b, c \in N$.

The neutrosophic triplet group, in general, is not a group in the classical algebraic way.

We consider, as the neutrosophic neutrals replacing the classical unitary element, and the neutrosophic opposites as replacing the classical inverse elements.

Example 3.2. *Consider*$(Z_{10}, \#)$*, where # is defined as* $a\#b = 3ab$

Let M_{10} = {0, 2, 4, 5, 6, 8} ⊂ Z_{10}. *Then (M_{10},#) is a neutrosophic triplet group under the binary #.*
It is also associative, i.e.

(a#b)#c=a#(b#c).

Now take L. H. S to prove the R. H. S, so

a#(b#c)=3ab#c.

,

3(3ab)c=9abc,
3a(3bc)=3a(b#c),
a#(b#c).

The classical unitary element on Z_{10} with respect to the law # is *e = 7, since:*

a # e = e # a = 3ae = 3a(7) = 21a = a (mod 10) for any *a* ∈ Z_{10}.

Therefore, we choose all triplets whose neutral elements are different from *7*, and we get the following neutrosophic triplets:

(0, 0, 0), (0, 0, 2), (0, 0, 4), (0, 0, 5), (0, 0, 6), (0, 0, 8), (2, 2, 2), (4, 2, 6), (5, 5, 5), (6, 2, 4), and *(8, 2, 8).*

All above neutrals *neut(.) = 0, 2,* and *5* are different from the classical unitary element *7.*

Z_{10} is not a neutrosophic triplet group, nor even a neutrosophic triplet set.

But its subset M_{10} *= {0, 2, 4, 5, 6, 8}* is a commutative neutrosophic triplet group, since the law # is well-defined, commutative, associative, and each element belonging to *M* has a corresponding neutrosophic triplet.

Definition 3.3: Let $(N,*)$ be a neutrosophic triplet group. Then N is called a commutative neutrosophic triplet group if for all $a, b \in N$ we have $a * b = b * a$.

Example 3.4. Consider *(M, *),* where *M = {0, 1},* and the binary law * is defined as

*a*b = a + b - ab (mod 4)* for all *a, b ∈ M.*

Then *(M, *)* is a not a neutrosophic triplet group, not even a neutrosophic triplet set.

Proof.

The law * has a classical algebraic unitary element *e = 0*, since:

For any *a ∈ M, a*0 = 0*a = a + 0 – a×0 = a (mod 4).*

Therefore, (M, *) cannot be a neutrosophic triplet group.

Theorem 3.5. Every idempotent element gives rise to a neutrosophic triplet.

Proof. Let a be an idempotent element. Then by definition $a^2 = a$. Since $a^2 = a$, which clearly implies that $neut(a) = a$ and $anti(a) = a$. Hence a gives rise to a neutrosophic triplet (a, a, a) .

Theorem 3.6. There are no neutrosophic triplets in Z_n with respect to multiplication modulo *n* if n is a prime, except the zero neutrosophic triplets *(0, 0, 0), (0, 0, 1), …, (0, 0, n-1).*

Proof. It is obvious. The multiplication modulo *n* is well-defined, associative, and commutative.

For *n = 2* (even prime), $Z_2 = \{0, 1\}$ has the classical algebraic unitary element, with respect to multiplication modulo 2, *e = 1*, and Z_2 has the zero neutrosophic triplets *(0, 0, 0), (0, 0, 1).*

Whence Z_2 is a not a neutrosophic triplet group, not even a neutrosophic triplet set.

Let $Z_n = \{0, 1, 2, \ldots, n-1\}$, for *n* odd prime. The classical algebraic unitary element of Z_n is *1*, and the zero neutrosophic triplets are *(0, 0, 0), (0, 0, 1), …, (0, 0, n-1).*

Let's compute the neutral of $2 \leq p \leq p - 1$, if any, let *neut(p) = x.* We need to find *x*.

px = p (mod n), or *px – p = 0 (mod n),* or *p(x-1) = 0 (mod n),*

whence *x-1 = 0 (mod n)* since *n* is an odd prime, and *n* and *p* are relatively prime numbers,

or *x = 1 (mod n),* therefore there is no neutral of the elements $p \in \{2, 3, \ldots, n-1\}$, since *1* is excluded as classical algebraic unitary element. Thus no neutrosophic triplets corresponding to the elements *2, 3, …, n-1 ∈ Z_n.*

Remark 3.6.1. Let $(N,*)$ be a neutrosophic triplet group under $*$ and let $a \in N$. Then $neut(a)$ is not the same for all elements in *N* (as in classical group), but $neut(a)$ depends on the a and on the operation $*$.

(In example 3.8, *neut(0) = 0, neut(4) = 4, neut(8) = 4* and *neut(9) = 9*, so we have three different neutral elements: *0*, *4*, and *9*.)

Theorem number 3.6.2. Let $(N,*)$ be a neutrosophic triplet group under $*$ that satisfies the cancellation law for all its elements. Then, for any *a* in N, the *neut(a)* and *anti(a)* are unique and depend on *a*.

Proof: Suppose *neut$^{(1)}$(a)* and *neut$^{(2)}$* (a) be two neutrals of *a*.

Then since neut$^{(1)}$(a)*a= neut$^{(2)}$ (a)*a, and by cancellation law to the right-hand side, we have *neut$^{(1)}$(a)= neut$^{(2)}$ (a).*

Similarly, if *a*neut$^{(1)}$(a)= a*neut$^{(2)}$ (a),* by cancellation law to the left-hand side, we have *neut$^{(1)}$(a)= neut$^{(2)}$ (a).*

In the same way, since *anti$^{(1)}$(a)*a= anti$^{(2)}$ (a)*a,* we get *anti$^{(1)}$(a)= anti$^{(2)}$(a),* by cancellation law to the right-hand side.

Again, since *a*anti$^{(1)}$(a) = a*anti$^{(2)}$(a),* we get *anti$^{(1)}$(a)= anti$^{(2)}$(a),* by cancellation law to the left-hand side.

Theorem 3.6.3. If the elements *a* of NTG do not satisfy the cancellation law, then still for each *a* in NTG the *neut(a)* is unique and depending on *a*, but the *anti(a)* may not be unique.

Proof.

Let's suppose that *neut$^{(1)}$(a)* and *neut$^{(2)}$(a)* are two neutrals of *a*, we have

*neut$^{(1)}$(a)=a*anti$^{(1)}$(a)=(neut$^{(2)}$(a)*a)* anti$^{(1)}$(a)*

=neut$^{(2)}$(a)(a* anti$^{(1)}$(a))*

=neut$^{(2)}$(a) neut$^{(1)}$(a)*

*=(anti$^{(2)}$(a)*a)* neut$^{(1)}$(a)*

=anti$^{(2)}$(a)(a* neut$^{(1)}$(a))*

*= anti$^{(2)}$(a)*a*

=neut$^{(2)}$(a).

Yet, *anti(a)* is not unique.

To prove this, let's take a look at the following example.

Example 3.8. Let N=(0,4,8) be a commutative neutrosophic triplet group under multiplication modulo 12 in

(Z_{12}, N). *N* does not have a classical unitary element.
Then $neut(4) = 4$, $neut(8) = 4$ and $anti(0) == \{0,4,8,9\}$, neut(0) = 0 and *anti(0) = {0, 4, 8, 9}.* This shows that $neut(a)$ is not the same for all elements as in classical group theory; further, each element has only one neutral. Also, the element *0* has four *anti(0)'*s.
The neutrosophic triplets are: *(0, 0, 0), (0, 0, 4), (0, 0, 8), (0, 0, 9), (4, 4, 4), (8, 4, 8), (9, 9, 9).*
Remark 3.9. Let $(N,*)$ be a neutrosophic triplet group with respect to * and let $a \in N$. Then $anti(a)$ is not the same for all elements in N and also anti(N) depends on the element a and on the operation *, and some elements may have many anti's unlike classical group and generalized group.
To prove the above remark, let's take a look to the following example.
Example 3.10. Let N be the commutative neutrosophic triplet group in the above Example 3.8. Then *anti(0) = {0, 4, 8, 9}, anti(4)=4* , anti(8)=8 and anti(9)=9. Therefore, the element 0 has four anti's, and the anti's of the elements are different from each other: 4, 8, 9, and 0.
Proposition 3.11. Let (N, *) be a neutrosophic triplet group with respect to * and let
A
$a, b, c \in N$. Then
1) a*b=a*c if and only if neut(a)*b=neut(a)*c.
2) b*a = c*a if and only if b*neut(a)=c*neut(a).

Proof. 1. Suppose that a*b=a*c. Since N is a neutrosophic triplet group, so $anti(a) \in N$. Multiply anti(a) to the left side of a*b=a*c.

anti(a)*a*b=anti(a)*a*c
[anti(a)*a]*b=[anti(a)*a]*c
neut(a)*b=neut(a)*c

Conversely suppose that neut(a)*b=neut(a)*c.
Multiply a to the left side, we get:

$$[a * neut(a)] * b = [a * neut(a)] * c.$$
$$a * b = a * c$$

2. The proof is similar to 1.
Proposition 3.12. Let (N,*) be a neutrosophic triplet group with respect to * and let
$a, b, c \in N$.
1) If anti(a)*b=anti(b)*c, then neut(a)*b=neut(a)*c.
2) If b*anti(a), then c*anti(a), then b*neut(a)=c*neut(a).

Proof. 1-. Suppose that anti(a)*b=anti(a)*c. Since N is a neutrosophic triplet group with respect to *, so $a \in N$. Multiply a to the left side of anti(a)*b=anti(a)*c, we get:

a*anti(a)*b=a*anti(a)*c
[a*anti(a)]*b=[a*anti(a)]*c
neut(a)*b=neut(a)*c.

2. The proof is the same as (1).
Theorem 3.13. Let (N,*) be a commutative neutrosophic triplet group with respect to * and $a, b, n \in N$. Then

neut(a)*neut(b)=neut(a*b).

Proof. Consider left hand side,neut(a)*neut(b)=neut(a*b).
Now multiply to the left with a and to the right with b , we get:

a*neut(a*b)*b=[a*b]*[neut(a*b)], as * in asociative
=a*b.

Now consider right hand side, we have neut(a*b).
Again multiply to the left with a and to the right with b, we get:

a*neut(a*b)*b , as is associative,
=a*b.

This completes the proof.
Theorem 3.14. Let (N,*) be a commutative neutrosophic triplet group with respect to * and $a, b \in N$. Then

anti(a)*anti(b)=anti(a*b).

Proof. Consider left hand side, anti(a)*anti(b).
Multiply to the left with a and to the right with b, we get:

a*anti(a)*anti(b)*b=[a*anti(a)]*[anti(b)*b]
=neut(a)*neut(b)
=neut(a*b), from the above theorem.

Now consider right hand side, which is anti(a*b).
Multiply to the left with a and to the right with b, we get:

a*anti(a*b), since * is associative.
neut(a*b).

This shows that anti(a)*anti(b) is true for all $a, b \in N$.

Theorem 3.15. Let (N,*) be a commutative neutrosophic triplet group under * and $a, b \in N$. Then

1) neut(a)*neut(b)=neut(b)*neut(a).
2) anti(a)*anti(b)=anti(b)*anti(a).

Proof 1. Consider right hand side neut(b)*neut(a). By Theorem 3, we have

neut(b)*neut(a)=neut(b)*neut(a), as N is commutative,
neut(a)*neut(b), again by Theorem 3.

Hence neut(a)*neut(b)=neut(b)*neut(a).

2) On similar lines, one can easily obtained the proof of (2).

{Actually, both proofs could also result straightforwardly from the commutative property of the neutrosophic triplet group.}

Definition 3.16. Let (N,*) be a neutrosophic triplet group under * and let H be a subset of N. Then H is called a neutrosophic triplet subgroup of N if H itself is a neutrosophic triplet group with respect to*.

Proposition 3.18. Let (N,*) be a neutrosophic triplet group and let $a \in N$ be a subset ofN. Then H is a neutrosophic triplet subgroup of N if and only if the following conditions hold.

1) $a * b \in H$ for all $a, b \in H$.
2) $neut(a) \in H$ for all $a \in H$.
3) $anti(a) \in H$ for all $a \in H$.

Proof. The proof is straightforward.

Definition 3.19. Let N be a neutrosophic triplet group and let $a \in N$. A smallest positive integer $n \geq 1$ such that is called neutrosophic triplet order {with respect to a given *neut(a)*, when the case when there are many neutrals of a}. It is denoted by nto(a).

Theorem 3.21. Let (N,*) be a neutrosophic triplet group with respect to * and let $a \in N$. Then

1) neut(a)*neut(a)=neut(a).

In general $(neut(a))^2 = neut(a)$, where n is a non-zero positive integer.

2) neut(a)*anti(a)=anti(a)*neut(a)=anti(a).

(Theorem 3.21 (1) and (2) were proven in Theorem 2.3. (1) and (2), except $(neut(a))^n = neut(a)$.)

Proof. Consider neut(a)*neut(a)=neut(a).
Multiply a to the left side, we get;

a* neut(a)*neut(a)=a*neut(a)
[a* neut(a)]*neut(a)=[a*neut(a)]
a*neut(a)=a
a=a.

On the same lines, we can see that $(neut(a))^2 = neut(a)$ for a non-zero positive integer n.

2) Consider neut(a)*anti(a)=anti(a).
Multiply to the left with a, we get;

a* neut(a)*anti(a)=a*anti(a)
a* anti(a)=neut(a)
neut(a)=neut(a)
a=a.

Similarly anti(a)*neut(a)=anti(a).

Definition 3.22. Let N be a NTG. If $N = \langle a \rangle$ for some $a \in N$, then N is called a neutro-cyclic triplet group" is better for the definition.

We say that a is a generator part of the neutrosophic triplet group.

Theorem 3.24. Let N be a neutro-cyclic triplet group and let a be a generator part of the neutrosophic triplet. Then

1) $\langle neut(a)\rangle$ generates neutro-cyclic triplet subgroup of N.
2) $\langle anti(a)\rangle$ generates neutro-cyclic triplet subgroup of N.

Proof. Straightforward.

4 Neutro-Homomorphism

In this section, we introduce the neutro-homomorphism for the neutrosophic triplet groups. We also study some of their properties. Further, we defined neutro-isomorphisms.

Definition 4.1. Let $(N_1,*_1)$ and $(N_2,*_2)$be two neutrosophic triplet groups. Let

$$f: N_1 \to N_2$$

be a mapping. Then f is called neutro-homomorphism if for all $a, b \in N_1$we have

1) $f(a *_1 b) = f(a) *_1 f(b)$,
2) $f(neut_2(a)) = neut_2(f(a))$, and
3) $f(anti_{*_1}^{(k_1)}(a)) = anti_{*_2}^{(k_2)} f(a)$,

where $k_1 = 1, 2, \ldots$ is the order of the neutrosophic triplet *(a, neut*1(a), anti*1(a))* in the case when the element *a* has more opposites, and one uses the notations:

$$(a, neut_{*_1}(a), anti_{*_1}^{(1)}(a)), (a, neut_{*_1}(a), anti_{*_1}^{(2)}(a)), (a, neut_{*_1}(a), anti_{*_1}^{(3)}(a)), \text{ etc.}$$

and similar notations for the second law $*_2$:

$$(b, neut_{*_2}(b), anti_{*_2}^{(1)}(b)), (b, neut_{*_2}(b), anti_{*_2}^{(2)}(b)), (b, neut_{*_2}(b), anti_{*_2}^{(3)}(b)), \text{ etc.}$$

Theorem 4.1.

Axioms (1), (2), and (3) are equivalent to extending the one-variable (neutro-homomorphism) function *f(x)* to three-variable (neutro-homomorphism) function *F(x, y, z),* defined as follows:

$$F: N_1^3 \to N_2^3$$

if $(a, b, c) \in N_1^3$ is a neutrosophic triplet, then

$$F(a, b, c) = (f(a), f(b), f(c)) \in N_2^3$$

is also a neutrosophic triplet.

Hence in general, for $k_1, k_2 = 1, 2, \ldots,$ one has:

$$F(a, neut_{*_1}(a), anti_{*_1}^{(k_1)}(a)) = (f(a), f(neut_{*_1}(a)), f(anti_{*_1}^{(k_1)}(a)))$$
$$= (f(a), neut_{*_2} f(a), anti_{*_2}^{(k_2)} f(a)).$$

Proof. Almost straightforwardly.

We construct a well-defined law of neutrosophic triplets $\#_1$ on N_1^3 as follows:
for any two neutrosophic triplets *(a, b, c)* and *(α, β, γ)* from N_1^3, one has:
$(a, b, c) \#_1 (\alpha, \beta, \gamma) = (a *_1 \alpha, b *_1 \beta, c *_1 \gamma)$,
and a well-defined law of neutrosophic triplets $\#_2$ on N_2^3 as follows:
for any two neutrosophic triplets *(u, v, w)* and *(δ, ε, ζ)* from N_2^3, one has:
$(u, v, w) \#_2 (\delta, \varepsilon, \zeta) = (u *_2 \delta, v *_2 \varepsilon, w *_2 \zeta)$.
Whence,
$F((a, b, c) \#_1 (\alpha, \beta, \gamma)) = F(a *_1 \alpha, b *_1 \beta, c *_1 \gamma) = (f(a *_1 \alpha), f(b *_1 \beta), f(c *_1 \gamma))$
$= (f(a) *_2 f(\alpha), f(b) *_2 f(\beta), f(c) *_2 f(\gamma))$.
And further, for $b = neut_{*_1}(a)$, $c = anti_{*_1}^{(k11)}(a)$, and respectively $\beta = neut_{*_1}(\alpha)$, $\gamma = anti_{*_2}^{(k12)}(\alpha)$, one gets:
$F((a, neut_{*_1}(a), anti_{*_1}^{(k11)}(a)) \#_1 (\alpha, neut_{*_2}(\alpha), anti_{*_2}^{(k12)}(\alpha))) =$
$F((a *_1 \alpha), (neut_{*_1}(a) *_1 neut_{*_1}(\alpha)), (anti_{*_1}^{(k11)}(a)) *_1 (anti_{*_1}^{(k12)}(\alpha))) =$
$(f(a *_1 \alpha), f(neut_{*_1}(a) *_1 neut_{*_1}(\alpha)), f(anti_{*_1}^{(k11)}(a) *_1 anti_{*_1}^{(k12)}(\alpha))) =$
$(f(a) *_2 f(\alpha), f(neut_{*_1}(a)) *_2 f(neut_{*_1}(\alpha)), f(anti_{*_1}^{(k11)}(a)) *_2 f(anti_{*_1}^{(k12)}(\alpha))) =$
$(f(a) *_2 f(\alpha), neut_{*_2}(f(a)) *_2 neut_{*_2}(f(\alpha)), anti_{*_2}^{(k21)}(f(a)) *_2 anti_{*_2}^{(k22)}(f(\alpha))) =$
$F(a, neut_{*_1}(a), anti_{*_1}^{(k11)}(a)) \#_2 F(\alpha, neut_{*_1}(\alpha), anti_{*_1}^{(k12)}(\alpha))$.
Therefore *F(x, y, z), for (x, y, z)* neutrosophic triplets in N_1^3, is its self a neutro-homomorphism.

Proposition 4.3. Every neutro-homomorphism is a classical homomorphism by neglecting the classical unitary element in classical homomorphism.

Proof. First, we neglect the classical unitary element that classical homomorphism maps unitary element to the corresponding unitary element. Now suppose that f is a neutro-homomorphism from a neutrosophic triplet group N_1 to a neutrosophic triplet group N_2. Then by condition (1), it follows that f is a classical homomorphism.

Definition 4.4. A neutro-homomorphism is called neutro-isomorphism if it is one-to-one and onto.

5 Distinctions and Comparison

The distinctions between Molaei's Generalized Group [7] and Neutrosophic Triplet Group are:

I. - in MGG for each element there exists a unique neutral element, which can be the classical group unitary element; while in NTG each element may have a unique neutral element but which is different form the classical element;

II. - in MGG there exists a unique inverse of an element, while in NTG there may be many inverses for the same given element;

III. - MGG has a weaker structure than NTG.

IV. - Smarandache (2016-2017) has generalized the NTG to Neutrosophic Extended Triplet Group (NETG), where the *neut(x)* is allowed to be equal to the classical unitary algebraic element of the group theory [14-16].

So far the applications of neutrosophic triplet sets are in Z, modulo n, n ≥ 2.

But new applications can be found, for example in social science:

One person <A> that has an enemy $\langle anti(A_{d_1}\rangle$(enemy in a degree d_1 of enemy-city), and a neutral person $\langle neut(A_{d_1}\rangle$ with respect to$\langle anti(A_{d_1}\rangle$. Then another enemy $\langle anti(A_{d_2}\rangle$ in a different degree of enemy-city, and a neutral $\langle neut(A_{d_2}\rangle$, and so on. Hence one has the neutrosophic triplets:

$$\langle A, \langle neut\ (A_{d_1})\rangle, \langle anti\ (A_{d_1})\rangle\ \rangle,$$
$$\langle A, \langle neut\ (A_{d_2})\rangle, \langle anti\ (A_{d_2})\rangle\ \rangle\ \text{, and so on.}$$

Then we take another person B in the same way...

$$\langle A, \langle neut\ (B_{d_1})\rangle, \langle anti\ (B_{d_1})\rangle\ \rangle,$$
$$\langle A, \langle neut\ (B_{d_2})\rangle, \langle anti\ (B_{d_2})\rangle\ \rangle\ \text{etc.}$$

More applications may be found, if we deeply think about cases where we have neutrosophic triplets $\langle A, \langle neut\ (A)\rangle, \langle anti\ (A)\rangle\ \rangle$ in technology and in science.

Acknowledgement:

There is no conflict of interest in the manuscript. We are very thankful to Prof. Muhammad Zafarullah from USA for his valuable comments and suggestion that improved this paper.

We are also grateful to Dr. Yılmaz Çeven, from Süleyman Demirel University, Isparta, Turkey, for his valuable remarks about the paper.

Conclusion

Inspired on the Neutrosophic philosophy, we defined for the first time the neutrosophic triplet. Basically, a neutrosophic triplet is a triad of certain elements, which satisfy certain axioms, which highly depend upon the proposed binary operation. The main theme of this paper is first to introduce the neutrosophic triplets, which are completely new notions, and then apply these neutrosophic triplets to introduce the neutrosophic triplet groups. This neutrosophic triplet group has several extra-ordinary properties as compared to the classical group. We also studied some interesting properties of this newly born structure. We further defined neutro-homomorphisms for neutrosophic triplet groups. A neutro-homomorphism is the generalization of the classical homomorphism with two extra conditions. As a further generalization, we gave rise to a new field or research called Neutrosophic Triplet Structures (such as neutrosophic triplet ring, neutrosophic triplet field, neutrosophic triplet vector space, etc.). In the end, we offered main distinctions and comparison of neutrosophic triplet group with the Molaei's generalized group as well as the possible application areas for the neutrosophic triplet groups.

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Received: January 18, 2019. Accepted: May 8, 2019

Neutrosophic model to measure the impact of management projects on the process of pedagogical-research training

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Abstract This paper presents the influence of the research training process, which is based on the institutional dynamics, the management projects of the teaching and the educational process. The main issues present in the management of the pedagogical-research training process of the Faculty of Administrative Sciences of the University of Guayaquil are identified. In order to measure the impact of the management projects of the pedagogical-research training process on teachers of administrative careers, Neutrosophy techniques for multicriteria decision making are used. These techniques contribute to recommend the indicators of greatest incidence which affect the adequate development of the proposed projects. They are based on the interpretation of qualitative results, obtained from the analysis proposed in this paper. For this reason, this paper aims to design and apply a model to measure the impact of the management project of the process of pedagogical-research training on teachers of administrative careers. The model can be used beyond the scope of the Faculty of Administrative Sciences of the University of Guayaquil.

Keywords: educational management, pedagogical-research training process, Neutrosophy, multicriteria decision making

1 Introduction

The knowledge, particularly in Knowledge Societies, is characterized by the accumulation and the gradual loss of its value and by the diversity of the spaces where it is constructed and applied. This accelerated rhythm demands of institutions readies to assume the current general transformations. This purpose is achieved when the institutions count on qualified educators, adequate curricular proposals, novel and efficient pedagogical practices and schools provided by emotionally positive environments. Initiatives for educators' training are necessary in order to achieve the goals and to complete the innovation and the transformation of the education in favor of the human development, see [1].

Nowadays, university institutions have led knowledge production processes, which has having a positive impact on the management of the pedagogical-research training process. University research institutions have the constitutive mission of producing knowledge, transmitting knowledge and training new researchers, thus, providing a new way for looking at and conceiving the world, this is the so-called postmodernity, see [2].

Knowledge management in universities positively contributes to the knowledge-based economies of these institutions; nevertheless, it is an increasing challenge for them. Moreno et al. refer in [3], that this phenomenon is directly related to macro and micro structural variables, associated to policies of investment and economic financing in science and technology to countries and regions; but, at the same time, to internal situations inside the university institutions, specifically in curricular policies, training programs for researchers and pedagogical and didactic processes.

In the specialized literature, we can find diverse starting points and terms associated to the concept of pedagogical-research training, among those studies the approaches in [4, 5] can be consulted. These authors refer to starting points that lead to different concepts and scopes, like the work performance, the pedagogical professional performance, the performance from the workplace, the socially desired professional performance, among others, which constitute factors to be taken into account in the pedagogical-research training process.

In contrast, the systematization of the studies, see [6], makes possible to recognize the main characteristics present in the models of pedagogical-research training, they are:

- The presence of knowledge reproduction, which schematizes the characteristics of reality.
- The operativity and facility they offer for studying the target phenomena.
- By means of only one model, it is possible to represent an actual phenomena emitted by several models.
- The variables, relationships and constants in the model are interpreted by scientific theories.

Specifically in the University of Guayaquil (UG) we evidenced that the postgraduate's logic in the formation process, possesses a detached character in agreement to the research necessities of the pedagogical formation. Particularly, teachers' improvement and training are oriented to the study of Business Administration in The Faculty of Administrative Sciences of the University of Guayaquil. The process of pedagogical-research formation of the teachers occupies the foundations of the referred roles of the postgraduate's formation where it is advocated for:

- The response to society's expectations and necessities in terms of scientific and technological development.
- To promote the formative process in order to link the students to maintain in them the effective and efficient knowledge in the different fields of science and technology.
- To establish a knowledge management in harmony with the research processes and the students' linkage.

The elements above explained, justify the necessity to conceive a management project for the teachers' pedagogical-research formation process in the Faculty of Administrative Sciences of the University of Guayaquil, which includes the integration of high quality instructions and researches. Such project aims to achieve creative professionals' formation, which should be able to re-learning and re-inventing.

Thus, this paper aims to design a neutrosophic model, which is developed to measure the impact of certain indicators in the projects management during the pedagogical-research training process on the teachers of the Faculty of Administrative Sciences of the University of Guayaquil. These indicators are provided in a qualitative way, where we make use of linguistic terms. Moreover, techniques of neutrosophy designed to solve multicriteria decision making problems are applied. The advantage to use neutrosophy over fuzzy theory or over the intuitionistic fuzzy theory is that indeterminacy is included in the calculus. Indeterminacy is part of real life to make decisions, nevertheless, despite that persons are able to make decisions efficiently.

Some previous approaches to neutrosophic Multicriteria Decision Making can be read in [7, 8, 9, 10, 11, 12, 13, 14, 15, 16]. Several are dedicated to the design of decision making models and others to the application to real life problems.

This paper is divided as follows; Section 2 is dedicated to expose the previous concepts which serve as the theoretical basis on the rest of the paper. In Section 3 calculus and their interpretations are discussed. In Section 4 conclusions are drawn.

2 Preliminaries

This section is devoted to recall basic concepts of neutrosophic theory and to introduce the proposed model.

Definition 1 Let X be a universe of discourse, a space of points (objects) and x denotes a generic element of X. A *neutrosophic set* A in X is characterized by a truth-membership function $T_A(x)$, an indeterminacy-membership function $I_A(x)$, and a falsity-membership function $F_A(x)$. Where, $T_A(x)$, $I_A(x)$, $F_A(x) \subseteq]^-0, 1^+[$, i.e., they are real standard or nonstandard subsets of the interval $]^-0, 1^+[$. These functions do not satisfy any restriction, that is to say, the following inequalities hold:

$^-0 \leq \inf T_A(x) + \inf I_A(x) + \inf F_A(x) \leq \sup T_A(x) + \sup I_A(x) + \sup F_A(x) \leq 3^+$.

Definition 2 Let X be a universe of discourse, a space of points (objects) and x denotes a generic element of X. A *Single Valued Neutrosophic Set* (SVNS) A in X is characterized by a truth-membership function $T_A(x)$, an indeterminacy-membership function $I_A(x)$, and a falsity-membership function $F_A(x)$. Where, $T_A(x)$, $I_A(x)$, $F_A(x)$: $X \rightarrow [0, 1]$ such that: $0 \leq T_A(x) + I_A(x) + F_A(x) \leq 3$. A *single valued neutrosophic number* (SVNN) is symbolized by <T,I,F> for convenience, where T, I, F$\in$ [0, 1] and 0$\leq$ T+ I+ F$\leq$3.

Therefore, $A = \{\langle x, T_A(x), I_A(x), F_A(x)\rangle : x \in X\}$ or more simply $A = \langle T_A(x), I_A(x), F_A(x)\rangle$, for every $x \in X$.

Given A and B two SVNSs, they satisfy the following relationships:

1. $A \subseteq B$ if and only if $T_A(x) \leq T_B(x)$, $I_A(x) \geq I_B(x)$ and $F_A(x) \geq F_B(x)$. Particularly, $A = B$ if and only if $A \subseteq B$ and $B \subseteq A$.
2. $A \cup B = \langle \max(T_A(x), T_B(x)), \min(I_A(x), I_B(x)), \min(F_A(x), F_B(x))\rangle$, for every $x \in X$.
3. $A \cap B = \langle \min(T_A(x), T_B(x)), \max(I_A(x), I_B(x)), \max(F_A(x), F_B(x))\rangle$, for every $x \in X$.

Decision making is an unavoidable process, which is essential in many real life situations. Such a process contains stages like the following:

1. To define the decision making problem

2. To analyze the problem and identify alternatives for the solution
3. To establish the criteria of assessment
4. To select experts
5. To assess the alternatives
6. To rank the choices and select the best of them

Many mathematical theories are dedicated to solve decision making problems, including neutrosophy theory.

The aggregation operator is a well-known concept in fuzzy theory, which has been naturally extended to neutrosophic theory and they are used to fusion information. It is utilized for the aggregation or fusion of some input values to obtain an only one output value. It is useful in decision making information, see [17].

Multicriteria decision making is a decision making process where the number of criteria is more than one, i.e., the criteria C_1, C_2, …, C_n satisfy n>1. We have a Group Decision, when the number of Decision Makers is more than one.

The concept of Aggregation operator is formally defined in Definition 3.

Definition 3 Let *X* be a universe of discourse, a space of points (objects) and *x* denotes a generic element of *X*. ***A*** is a *Single Valued Neutrosophic Aggregation Operator* (SVNAO) if it is a mapping $\boldsymbol{A}$: $\cup_{n\in\mathbb{N}}\ ([0,1]^3)^n \rightarrow [0,1]^3$.

An example of SVNAO is the *Single Valued Neutrosophic Weighted Average operator* (SVNWA), which is formally defined in Definition 4, see [14].

Definition 4 Let $a_j = \langle T_j, I_j, F_j\rangle$, j = 1, 2, … n, be a collection of single valued neutrosophic numbers, then, the *Single Valued Neutrosophic Weighted Average operator* (SVNWA), is defined by the formula in Equation 1.

$$\mathrm{SVNWA}_W(a_1, a_2, \dots, a_n) = \langle 1 - \prod_{j=1}^{n}(1 - T_j)^{w_j}, \prod_{j=1}^{n} I_j^{w_j}, \prod_{j=1}^{n} F_j^{w_j}\rangle \quad (1)$$

Where, W = (w_1, w_2, …, w_n) is the vector of weights, according to the importance assigned to every one of the attributes, such that, $w_i \in [0, 1]$ for i = 1, 2, …, n and $\sum_{i=1}^{n} w_i = 1$.

Another example of neutrosophic aggregation operator is the *Single Valued Neutrosophic Weighted Geometric Average operator* (SVNWG) defined by the formula in Equation 2, see Definition 5 and [14].

Definition 5 Let $a_j = \langle T_j, I_j, F_j\rangle$, j = 1, 2, … n, be a collection of single valued neutrosophic numbers, then, the *Single Valued Neutrosophic Weighted Geometric Average operator* (SVNWG), is defined by the formula in Equation 2.

$$\mathrm{SVNWG}_W(a_1, a_2, \dots, a_n) = \langle \prod_{j=1}^{n} T_j^{w_j}, 1 - \prod_{j=1}^{n}(1 - I_j)^{w_j}, 1 - \prod_{j=1}^{n}(1 - F_j)^{w_j}\rangle$$

(2)

Proposition 1 Given $a_1, a_2, \dots, a_n$ and W = (w_1, w_2, …, w_n), then some properties of SVNWA and SVNWG are the following:

1. They are symmetric. $\mathrm{SVNWA}_W(a_1, a_2, \dots, a_n) = \mathrm{SVNWA}_W(a_{p(1)}, a_{p(2)}, \dots, a_{p(n)})$ and $\mathrm{SVNWG}_W(a_1, a_2, \dots, a_n) = \mathrm{SVNWG}_W(a_{p(1)}, a_{p(2)}, \dots, a_{p(n)})$, where P = (P(1), P(2), …, P(n)) is a permutation function.
2. They are associative. $\mathrm{SVNWA}_W(\mathrm{SVNWA}_W(a_1, a_2), a_3) = \mathrm{SVNWA}_W(a_1, \mathrm{SVNWA}_W(a_2, a_3))$ and $\mathrm{SVNWG}_W(\mathrm{SVNWG}_W(a_1, a_2), a_3) = \mathrm{SVNWG}_W(a_1, \mathrm{SVNWG}_W(a_2, a_3))$.
3. $\mathrm{SVNWG}_W(a_1, a_2, \dots, a_n) \leq_N \mathrm{SVNWA}_W(a_1, a_2, \dots, a_n)$, where $\leq_N$ is a partial order, defined as: $\langle T_1, I_1, F_1\rangle \leq_N \langle T_2, I_2, F_2\rangle$ if and only if $T_1 \leq T_2$, $I_2 \leq I_1$ and $F_2 \leq F_1$.

Proof.

1. It is easy to prove.
2. See that $\prod_{j=1}^{n} T_j^{w_j}$, $\prod_{j=1}^{n} I_j^{w_j}$ and $\prod_{j=1}^{n} F_j^{w_j}$ are evidently associative. Also, it is easy to prove that $1 - \prod_{j=1}^{2}(1 - T_j)^{w_j}$, $1 - \prod_{j=1}^{2}(1 - I_j)^{w_j}$ and $1 - \prod_{j=1}^{2}(1 - F_j)^{w_j}$ are associative. Moreover, this property can be extended to $1 - \prod_{j=1}^{n}(1 - T_j)^{w_j}$, $1 - \prod_{j=1}^{n}(1 - I_j)^{w_j}$ and $1 - \prod_{j=1}^{n}(1 - F_j)^{w_j}$. Thus, both, SVNWA and SVNWG are associative.
3. See that $1 - \prod_{j=1}^{n}(1 - T_j)^{w_j} \geq \max_j T_j^{w_j}$, $1 - \prod_{j=1}^{n}(1 - I_j)^{w_j} \geq \max_j I_j^{w_j}$, $1 - \prod_{j=1}^{n}(1 - F_j)^{w_j} \geq \max_j F_j^{w_j}$, $\prod_{j=1}^{n} T_j^{w_j} \leq \min_j T_j^{w_j}$, $\prod_{j=1}^{n} I_j^{w_j} \leq \min_j I_j^{w_j}$ and $\prod_{j=1}^{n} F_j^{w_j} \leq \min_j F_j^{w_j}$, hence, according to Definitions 4 and 5 and the neutrosophic order, the inequality holds.□

Remark 1 Let us note that the previous properties are important for the aggregation calculus. Especially the last one indicates that the aggregation based on SVNWG is more "pessimistic" than that based on SVNWA.

The alternatives are ranked by using the scoring function defined in [18], see Equation 3.

$s(a_j) = 2 + T_j - F_j - I_j$ (3)

The definition of precision function is given in Equation 4.

$a(a_j) = T_j - F_j$ (4)

See that $s: [0,1]^3 \to [0,\ 3]$ and $a: [0,1]^3 \to [-1,\ 1]$.

Thus, we use the following preference order criteria:

1. If $s(a_j) < s(a_i)$, then we say that a_i is preferred over a_j, and it is denoted by $a_j \prec a_i$ or equivalently by $a_i \succ a_j$.
2. If $s(a_j) = s(a_i)$ then,

2.1. If $(a_j) < a(a_i)$, then we say that a_i is preferred over a_j or $a_j \prec a_i$.

If $s(a_j) = s(a_i)$ and $(a_j) = a(a_i)$, then we say that a_i and a_j are equally preferred and it is denoted by $a_i \sim a_j$. The scoring function is used to rank and evaluate the alternatives.

Other property of the fuzziness, including neutrosophy is the possibility it offer to deal with the vagueness of the natural language. Decision making includes the criteria given by experts on the subject, whom are not necessarily experts in mathematics; therefore, it is important to express these criteria in natural language. Thus, Tables 3 and 4 are given, which associate a linguistic term with a SVNN, they was defined in [19].

Linguistic term	SVNN
Very important (VI)	<0.90, 0.10, 0.10>
Important (I)	<0.75, 0.25, 0.20>
Medium (M)	<0.50, 0.50, 0.50>
Unimportant (UI)	<0.35, 0.75, 0.80>
Very Unimportant (VUI)	<0.10, 0.90, 0.90>

Table 1: Importance weight as linguistic terms

Linguistic Term	SVNN
Extremely good (EG)	<1.00, 0.00, 0.00>
Very very good (VVG)	<0.900, 0.10, 0.10>
Very good (VG)	<0.80, 0.15, 0.20>
Good (G)	<0.70, 0.25, 0.30>
Medium good (MG)	<0.60, 0.35, 0.40>
Medium (M)	<0.50, 0.50, 0.50>
Medium bad (MB)	<0.40, 0.65, 0.60>
Bad (B)	<0.30, 0.75, 0.70>
Very Bad (VB)	<0.20, 0.85, 0.80>
Very very bad (VVB)	<0.10, 0.90, 0.90>
Extremely bad (EB)	<0.00, 1.00, 1.00>

Table 2: Linguistic terms to rate the importance of alternatives

From the documentary analysis and the researchers' experience in the Faculty of Administrative Sciences of the University of Guayaquil, we can infer that diverse factors affect the pedagogical-research training, among them we can mention:

- Curricular processes, which integrate the role of the curriculum and training strategies for research.
- The articles referring to the actors in the pedagogical-research training process allude to the variables that influence both, teachers and students (roles, attitudes, meanings, among others).
- The institutional conditions of the universities respect to the topic of interest.

Then, a model is developed based on the aggregation of information to measure the impact of management projects in the process of pedagogical and research training on teachers of administrative careers at the University of Guayaquil, Ecuador. The workflow proposed in this paper is shown in Figure 1.

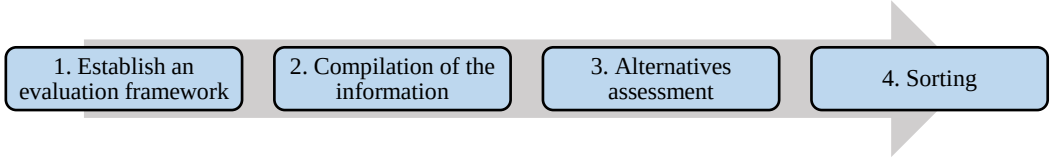

Figure 1: Scheme of the model based on the information aggregation to measure the impact of management projects on the

process of pedagogical-research training.

The proposed algorithm consists in the following steps:

Algorithm of the best alternative selection

1. To select the criteria: C_1, C_2, …, C_n.
2. To select the alternatives: X_1, X_2, …, X_m
3. The Expert or Experts select the linguistic term to assess the importance of every one of the criterion, from Table 1, let us denote it by: t_1, t_2, …, t_n. Every one of them is associated to one SVNN: $<T_1, I_1, F_1>$, $<T_2, I_2, F_2>$, …, $<T_n, I_n, F_n>$, which can be found in the right column of Table 1.
   Then, calculate $w_j = \frac{T_j}{\sum_{k=1}^{n} T_k}$, which are the weights of every criterion.
4. The Expert or Experts select from Table 2 the linguistic term to assess every alternative according to every criterion. An n×m table is formed, where the element in the i^{th} row, j^{th} column is the evaluation of X_j according to C_i.
5. To aggregate each column of alternatives for every row of criteria, applying the SVNWA. Where, the weights were calculated in the step 3, and the alternatives correspond to the SVNN associated to the linguistic evaluations given by experts, according to Table 2.
6. To calculate the scoring and ranking functions, according to Equations 3 and 4.
7. Select the best alternative, according to the preference order criteria.

Remark 2 When the number of experts is more than one, the experts' evaluations median is provided. The median is calculated by using the indexes representing the order of the linguistic terms. Once the median index is calculated, the term with the closest index is selected and this represents the expert group evaluation. In case the median index is (2i+1)/2, i is chosen.
See the Example 1 to illustrate this calculation. Hence, these values are used in the Algorithm of the best alternative selection.

Example 1 Suppose that four experts, E_1, E_2, E_3, and E_4 are evaluating the importance of the criterion 1, according to Table 1. E_1 and E_3 say it is Important (I), E_2 considers it is Medium (M) and E_4 says it is Very Important (VI). Alternatively, we have an order of the terms {VUI, UI, M, I, VI}, it is indifferent that either the order is ascending or descending.
Therefore, according to the previous order we have the indexes of the experts' evaluations, {4, 3, 4, 5} corresponding to {I, M, I, VI}, the median of the indexes is 4, then, the group evaluation corresponds to I. This procedure can be extended to the rest of the assessments.

3 Results

For the evaluation the linguistic terms defined in [11] are used, see Tables 1 and 2. Subsequently, the information is collected, related to the indicators and factors of major incidence in the process of pedagogical-research training, to measure the impact of management projects in the Faculty of Administrative Sciences of the University of Guayaquil. The results obtained are shown in Table 3, see the criteria (C_1, C_2 and C_3) and the alternatives (X_1, X_2 and X_3) selected by experts.

Experts assess the importance of C_1 as "Very Important" and both, C_2 and C_3, as "Medium". Then, according to Table 1, we have:
$w_1 = \frac{0.9}{0.9+0.5+0.5} = 0.47368$, $w_2 = w_3 = \frac{0.5}{0.9+0.5+0.5} = 0.26316$.

Therefore, The vector used to measure the impact of management projects of the process of pedagogical-research training on teachers of the Faculty of Administrative Sciences in the University of Guayaquil, Ecuador is W = (0.47368, 0.26316, 0.26316).

Table 3 contains the matrix of the experts' assessments for each alternative by criterion.

Criterion\Alternatives	X_1 (curricular processes indicator)	X_2 (indicator of actors in the process of pedagogical-research training)	X_3 (indicator of institutional conditions of universities)
C_1 (research training to the curriculum)	MG	EG	VG
C_2 (instrumental character assigned to pedagogy)	G	MG	B
C_3 (micro conditions of the institutions to carry out the processes of research training)	MG	MG	G

Table 3: Results of information collection.

Subsequently, the decision-makers' opinions are aggregated using the SVNWA aggregation operator; the results are summarized in Table 4.

Alternative	Aggregation	Scoring	Ranking
X_1	<0.62916, 0.32034, 0.37084>	1.9338	3
X_2	<1.00000, 0.00000, 0.00000>	3.0000	1
X_3	<0.69058, 0.26207, 0.30942>	2.1191	2

Table 4: Results of assessing

According to the scoring function, the proposed indicators are ordered as follows: $X_2 \succ X_3 \succ X_1$, which shows that the most important indicator correspond to the instrumental character assigned to pedagogy, denoting the need to delimit variables such as culture and the relations between teacher, student and teaching that require contextual and local research in order to understand deeply the potentialities and limitations of research training.

Next, attention should be paid to the micro conditions of institutions to carry out the processes of research training in order to address the issues of science and technology, with respect to the aspects of organizational culture of universities and economic investment.

This leads to paying attention to research training in the curriculum, which aims to form skills and habits proper to technical and scientific research work in students to solve problems and propose solutions to disciplinary and professional objects from the research methodology.

4 Conclusions

In the present paper, a documentary analysis is carried out to obtain elements related to the management of the process of pedagogical-research training, in order to measure the impact in the University of Guayaquil. The indicators to be taken into account are obtained and they are evaluated through a model based on the aggregation of useful information to quantify the indicators and to recommend those that are necessary to attend for the adequate achievement of the pedagogical research training in the students of the careers of Administration of the University of Guayaquil, Ecuador. The proposed model can be applied to other university institutions, interested to study their conditions on the pedagogical-research training.

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Received: January 11, 2019. Accepted: May 9, 2019

Neutrosophic statistics applied to the analysis of socially responsible participation in the community

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Abstract. Previous research points to the importance of the active and socially responsible participation of companies as members of the society to contribute to their economic and social development, i.e., a step beyond philanthropy. In this sense, this study aims to analyze the role played by the different organizations in the business sector of Imbabura in Ecuador, and its relationship with the community where they operate. The analysis was based on the different areas suggested within the ISO 26000 standards, such as education, culture, job creation, among others. The qualitative-quantitative approach was used, with descriptive scope. The survey and the interview were used as data collection techniques for which the respective instruments were designed and applied to different companies in the sector. The results of the instruments are quantified using neutrosophic statistics, which is useful for the quantitative analysis of citizens' participation in various activities developed in the community. According to the present study, the participation of the companies within the community is not significant and therefore, it is required to foment the responsibility of them in the social development and integration. Concepts like sustainability should be included in the company strategies, when trust and commitment want to be generated from communities in which companies develop their activities.

Keywords: Social capital, Participatory development, Social integration, Community participation, Neutrosophic statistics.

1 Introduction

According to [1], Social Responsibility refers to the fact that company's activities have an impact on society and therefore, they must be responsible for their actions and the consequences they bring with them. However, some of the questions that arise in the research of [2] cited in [3] are: (1) How to establish the limits between contributing to solving social problems such as unemployment, poverty, environmental pollution and sacrificing the economic benefits of companies? (2) How feasible is it for a company, not to increase the prices of its products and services to avoid falling into speculation or inflation, but at the same time to continue obtaining financial results that allow it to continue functioning?

Consequently, one could also ask: Do companies consider Socially Responsible as an investment or as an expense? In the case of being cataloged as an investment, what do companies seek? It can be said that they seek to achieve long-term benefits such as the recognition of society for their actions by contributing to the reduction of poverty and consequently obtaining an increase in their market value?, see [4]. Another objective benefit could be to wish clients' recognition, so that later they respond with loyalty when keep of buying their products and services. Or, on the contrary, it is considered an expense mainly because the benefits are subjective, i.e.,

they are not tangible and are difficult to quantify. In this case, we can ask ourselves whether corporate social responsibility practices obey a solidarity conscience that goes beyond ethics, philanthropy, and what the law requires to be complied with and that seeks to strengthen the world economy and environmental protection.

Going a little deeper about who should be responsible for applying such practices, if the companies or the people who work in the companies, we find two positions, on the one hand, the companies, in this case would be considered as active members of society, with the same rights and obligations, that is, as one more citizen according to [5]. On the other hand, if we take into account the main objective pursued by shareholders and owners of companies to maximize their profits [6], those called upon to have a socially responsible attitude would be the people who work in the companies.

In this sense, it is important that shareholders have socially responsible intentions since it is their money that is being used to carry out such social responsibility practices and that those who make decisions within companies, that is to say, the directors, also have this sense of responsibility since they are the executer. In this case, it would be the owners and those who work in the companies, the accountable to carry out socially responsible entrepreneurial actions [6] with it are favored and benefit all members of the organization, including the top management, middle and fundamental, the operational part of a company, as long as everything is committed, thereby generating a great sustainable impact, economic, and especially cultural [7].

Likewise, active participation of companies and community development called by ISO 26000 requires companies to work more closely with the communities in which they operate. In other words, it implies for companies not only the fact that they are aware of the impact of their activities on the environment as a spectator, but rather as a member who participates in the debates and proposes solutions to the different social and environmental problems that surround the community seeking for a better quality of life for all its members.

Some of the suggestions referred in ISO 26000 are: companies are called to actively participate in community decisions on unsatisfied social needs, even delegating a representative for their fulfillment. It also points out that companies should be involved in actions that promote education and culture, as well as job creation and skills development among their inhabitants. That they should contribute to the development and access to technology for social purposes and the generation of wealth.

An organization's contribution to community development can help to promote higher levels of well-being within the community. Such development is understood as the improvement of the quality of life of a population. Community development is not a linear process; rather, it is a long-term process, in which different and conflicting interests will be present. Historical and cultural characteristics make each community unique and influence the possibilities for its future. Community development is therefore the result of social, political, economic and cultural characteristics and depends on the characteristics of the social forces involved. Stakeholders in the community may have different interests, even conflicting interests. Shared responsibility is required to promote the well-being of the community as a common goal.

Key community development issues to which an organization can contribute include job creation through expansion and diversification of economic activities and technological development. It can also contribute with social investments [8] in generating wealth and income in the local economic development initiatives; expanding education and skills development programmes; promoting and preserving culture and the arts; and providing or promoting community health services. Community development could include institutional strengthening of the community, its collective groups and forums, cultural, social and environmental programs and local networks involving multiple institutions, because to build a professional statistical system capable of responding with quality and timeliness to the statistical information needs of each productive organization, promotes the achievement of business development goals, forming a necessity that expresses competitiveness and credibility [9].

Usually, community development is advanced when the social forces of the community strive to promote public participation, and pursue equal rights and decent living standards for all citizens, without discrimination. It is an internal community process that takes into account existing relationships and overcomes barriers to the enjoyment of rights. Community development is reinforced through socially responsible behavior.

Consequently, the objective of this study is to establish whether socially responsible practices towards the community are related to the active participation of the business sector in different areas such as education, culture, job creation among others suggested by ISO 26000 standards.

The use of Neutrosophy was proposed by Florentin Smarandache [10] for the treatment of neutrality, it is a branch of philosophy that studies the origin, nature and scope of neutrality. This has formed the basis for a series of mathematical theories that generalize classical and fuzzy theories such as neutrosophic sets and neutrosophic logic as referred in [10]. The original definition of truth value in neutrosophic logic is shown in [11].

Based on the theoretical analysis carried out, the use of neutrosophic statistics is required for the analysis of socially responsible participation in the community. Neutrosophic statistics are useful because they describe

the statistical calculation for several different samples, each of the same size. The use of single-valued neutrosophic sets [12] (SVNS) was proposed, which through them it is possible to use linguistic terms [10], in order to obtain a greater interpretability of the results obtained with this type of data.

With the use of classical statistics we know the data, formed by clear numbers, in neutrosophic statistics the data have some indetermination, the data can be ambiguous, vague, imprecise, incomplete, even unknown. Instead of sharp numbers used in classical statistics, sets (which approximate these sharp numbers respectively) are used in neutrosophic statistics [13, 14, 15, 16].

Additionally, in neutrosophic statistics, the sample size may not be known exactly (for example, the sample size may be between 90 and 100), this may happen because, for example, the statistician is not sure what approximately they refer to, which are the individuals in the sample whether or not they belong to the population of interest, or because the individuals in the sample only partially belong to the population of interest, while partially do not belong). Another approach would be to consider only partially the data provided by individuals in the sample whose membership in the population of interest is only partial.

2 Neutrosophy theory and Neutrosophic Statistics

This section is devoted to expose the basic concepts of Neutrosophic sets and Neutrosophic Statistics.

Definition 1 Let X be a universe of discourse, a space of points (objects) and x denotes a generic element of X. A *neutrosophic set* A in X is characterized by a truth-membership function $T_A(x)$, an indeterminacy-membership function $I_A(x)$, and a falsity-membership function $F_A(x)$. Where, $T_A(x)$, $I_A(x)$, $F_A(x) \subseteq]^-0, 1^+[$, i.e., they are real standard or nonstandard subsets of the interval $]^-0, 1^+[$. These functions do not satisfy any restriction, that is to say, the following inequalities hold:

$^-0 \leq \inf T_A(x) + \inf I_A(x) + \inf F_A(x) \leq \sup T_A(x) + \sup I_A(x) + \sup F_A(x) \leq 3^+$.

Definition 2 Let X be a universe of discourse, a space of points (objects) and x denotes a generic element of X. A *Single Valued Neutrosophic Set* (SVNS) A in X is characterized by a truth-membership function $T_A(x)$, an indeterminacy-membership function $I_A(x)$, and a falsity-membership function $F_A(x)$. Where, $T_A(x)$, $I_A(x)$, $F_A(x)$: $X \to [0, 1]$ such that: $0 \leq T_A(x) + I_A(x) + F_A(x) \leq 3$. A *single valued neutrosophic number* (SVNN) is symbolized by <T,I,F> for convenience, where T, I, F $\in [0, 1]$ and $0 \leq$ T+ I+ F≤ 3.

Therefore, $A = \{\langle x, T_A(x), I_A(x), F_A(x)\rangle : x \in X\}$ or more simply $A = \langle T_A(x), I_A(x), F_A(x)\rangle$, for every $x \in X$.

Given A and B two SVNSs, they satisfy the following relationships:

4. $A \subseteq B$ if and only if $T_A(x) \leq T_B(x)$, $I_A(x) \geq I_B(x)$ and $F_A(x) \geq F_B(x)$. Particularly, $A = B$ if and only if $A \subseteq B$ and $B \subseteq A$.
5. $A \cup B = \langle \max(T_A(x), T_B(x)), \min(I_A(x), I_B(x)), \min(F_A(x), F_B(x))\rangle$, for every x$\in$X.
6. $A \cap B = \langle \min(T_A(x), T_B(x)), \max(I_A(x), I_B(x)), \max(F_A(x), F_B(x))\rangle$, for every x$\in$X.

With regard to Neutrosophic Statistics, a *neutrosophic population* is a population where the membership of the individuals is not well defined and a level of indeterminacy could exist. A *neutrosophic sample* is a sample where indeterminacy is in some way present. The origin of indeterminacy can be due to the partial appurtenance of its members or because of the indeterminacy of this subset as a whole.

Example 1 Some examples of neutrosophic data are the following sets: {4, [2, 6], [7, 8], 10, 23, [20, 23)} and {5, [4, 7], {1, 2, 6}, (65, 70], (4, 5)}. See that some data are imprecise like [7, 8] and {1, 2, 6}, because the exact datum is not known. In the framework of a neutrosophic sample, we can also have an imprecise sample size, where the sample size can be stated in 90, 91, …, 100.

After proposing the instruments to obtain the results of the present study, neutrosophic statistics are used for the analysis of socially responsible participation in the community. The neutrosophic statistic is appropriate for this analysis since results are obtained that require interpretability. In that sense, Neutrosophy is used in these studies.

In Neutrosophic Statistics it is important to calculate using interval-valued operations, thus, in the following some of them are summarized. Let $I_1 = [a, b]$ and $I_2 = [c, d]$ be two real valued intervals, then, see [17]:

1. $I_1 \leq I_2$ if and only if $a \leq c$ and $b \leq d$.
2. $I_1 + I_2 = [a+c, b+d]$.
3. $I_1 - I_2 = [a-d, b-c]$.
4. $I_1.I_2 = [\min(ac, ad, bc, bd), \max(ac, ad, bc, bd)]$.
5. $1/I_1 = [1/b, 1/a]$, always that $0 \notin I_1$.
6. $I_1/I_2 = I_1.(1/I_2)$.
7. $\sqrt{I_1} = [\sqrt{a}, \sqrt{b}]$, if and only if $a \geq 0$.
8. $I_1^n = \underbrace{I_1 \cdot I_1 \cdot \cdots \cdot I_1}_{\text{n times}}$, $n \in \mathbb{N}$.

Definition 3 A *Neutrosophic Normal Distribution* is a normal distribution of the random variable X, where

either the median μ or the variance σ^2 (standard deviation σ) or both of them are imprecise.

A *neutrosophic hypothesis* satisfies that the statistics of the variables used to describe the population characteristics are neutrosophic or if at least one value which describe a population characteristic is neutrosophic. The *Neutrosophic Null Hypothesis*, denoted by NH_0, is the one which we have to prove it is true; also, the *Neutrosophic Alternative Hypothesis* is defined and denoted as NH_a.

Example 2 A neutrosophic hypotheses can be the following:

$$\begin{cases} NH_0: \mu \in [0,1] \\ NH_a: \mu > 1 \end{cases}, \begin{cases} NH_0: \mu \in [0,1] \\ NH_a: \mu < 1 \end{cases} \text{ or } \begin{cases} NH_0: \mu \in [0,1] \\ NH_a: \mu \notin [0,1] \end{cases}$$

There exists two neutrosophic type of errors, they are:

1. A *Neutrosophic Type I Error*, is the error of rejecting NH_0 when NH_0 is true.
2. A *Neutrosophic Type II Error*, is the error of not rejecting NH_0 when NH_0 is false.

A *Neutrosophic Level of Significance* α can be a set, in this framework α = [0.01, 0.05] can be defined.

Definition 4 A *Neutrosophic P-Value* p is the smallest level of significance such that NH_0 is rejected. See that the Neutrosophic P-Value is not necessarily a crisp value.

Definition 5 Limits of the *Neutrosophic Confidence Interval for the Population Mean* μ is calculated by the following formula:

$$\bar{x} \pm z_{\text{critical value}} \cdot \frac{s}{\sqrt{n}} \qquad (1)$$

Where n is the sample size, which can be an interval, α is the neutrosophic level of significance, s is the sample standard deviation and $\bar{x}$ is the sample mean.

Other distributions are defined as usual, e.g., $\chi^2 = \sum_{i=1}^{k} Z_i^2$, see [18, 19], where every Z_i are normal random variables, equally distributed with mean 0 and variance 1. Moreover, the hypothesis test can be naturally extended to neutrosophic hypothesis test. Also, test of normality, can be applied, taking into account the new definitions, e.g., Shapiro-Wilk normality test.

Linguistic terms can be associated to SVNN according to Table 1, defined in [20].

Linguistic Term	SVNN
Extremely good (EG)	(1,0,0)
Very very good (VVG)	(0.9, 0.1, 0.1)
Very good (VG)	(0.8,0,15,0.20)
Good(G)	(0.70,0.25,0.30)
Medium good (MDG)	(0.60,0.35,0.40)
Average(M)	(0.50,0.50,0.50)
Medium Bad (MDB)	(0.40,0.65,0.60)
Bad (B)	(0.30,0.75,0.70)
Very bad (VB)	(0.20,0.85,0.80)
Very very bad (VVB)	(0.10,0.90,0.90)
Extremely bad (EB)	(0,1,1)

Table 1: Linguistic terms and the associated SVNN

3 Results

For this study, the most appropriate research approach for testing a hypothesis is quantitative, and the type of scope defined is exploratory. The techniques used for data collection are based on measuring the number of companies that integrate active participation and community development as part of their social responsibility practices, and the number of managers and workers who expressed through a survey their perception of execution.

a. Sampling procedures

In order to prepare the Imbabura business projection table, the United Nations International Standard Industrial Classification (ISIC) and the business directory database for the years 2014, 2015, 2016 have been taken into account, a study conducted by the National Institute of Statistics and Censuses of Ecuador (INEC according to the abbreviation in Spanish), which presents 39,867 companies by 2014, 44,887 companies by 2015 and 49,985 companies by 2016, historical data that allowed forecasting through formula in Equation 2, the projection for 2017 and 2018:

$$M = C(1 + i)^{n-1} \quad (2)$$

Where:
i = Projection percentage
M = last element (49,985)
C= first element (39,867)
n = Historical period taken into account for the projection (3 years)

Year	Number of companies
2014	39,867
2015	44,887
2016	49,985

Table 2: Number of companies determined in the INEC. Source Directory of REDATAM-ECLAC Companies (2016)

$$49{,}985 = 39{,}867\ (1 + i)^{3-1}$$
$$i_{2018} = \sqrt{\frac{49{,}985}{39{,}867}} - 1$$
$$i_{2018} = 0.1138$$

The result of 0.1138 is equivalent to 11.38% for 2017 and 2018 multiplied by the last historical series of INEC (49,985 companies) resulting in 55,469 companies projected for 2017 and 62,479 companies for 2018. This information was organized by economic sectors for better identification and application of measurement instruments.

Let us remark that the population of enterprises in 2018 was forecasted from the population in 2016, calculated by a census. Census results are not completely accurate, because during the polls many changes can occur. Evidently the forecasted result is even less accurate. Thus, we can estimate the population size in the interval from 49,985 to 62,479 because there exists certain indeterminacy. For simplicity we take N = 62,479.

Code	*Economic activity*	*2014*	*2015*	*2016*	*Projection*		
					Rate	2017	2018
A	Agriculture, livestock, forestry and fishing	3,627	4,244	4,687	0.1368	5,328	6,057
B	Mining and quarrying	45	41	44	-0.0112	44	43
C	Manufacturing Industries	4,191	4,930	5,377	0.1327	6,090	6,899
D	Electricity, gas, steam and air conditioning supply	8	9	13	0.2748	17	21
E	Water distribution; sewerage, waste and sanitation	31	33	42	0.1640	49	57
F	Construction	1,568	1,858	2,049	0.1431	2,342	2,678
G	Trade, automotive repair and motorcycles	13,090	16,004	17,326	0.1505	19,933	22,933
H	Transport and storage	4,686	5,062	5,350	0.0685	5,716	6,108
I	Accommodation and meal service activities	3,333	3,724	4,157	0.1168	4,643	5,185
J	Information and communication	358	297	307	-0.0740	284	263
K	Financial and insurance activities	57	59	60	0.0260	62	63
L	Real estate activities	597	736	826	0.1763	972	1,143
M	Professional, scientific and technical activities	1,261	1,913	2,045	0.2735	2,604	3,316
N	Administrative and support services activities	1,025	833	880	-0.0734	815	756
O	Public administration and defense, social security	120	130	128	0.0328	132	137
P	Education	470	521	804	0.3079	1,052	1,375
Q	Human health care and social assistance activities	580	651	689	0.0899	751	818
R	Arts, Entertainment and Recreation	363	473	534	0.2129	648	786
S	Other service activities	4,457	3,369	4,138	-0.0365	3,987	3,842
	Total	39,867	44,887	49,456	0.1138	55,469	62,479

Table 3: Projection of the companies' classification in Imbabura. Source: Directory of companies, REDATAM-ECLAC (2016)

b. Procedure for the selection of participants

Once the information was consolidated, the cadastral database was classified by primary units (cantons), secondary units (uniform international industrial classifier version 4.0), and final units (companies), a number selected according to the projected size of the primary units.

We also took into consideration those businesses that were active at the time of the investigation, so we eliminated from the study those companies that, at the time of verifying telephones, addresses did not coincide with the databases provided by the municipal cadastres.

Based on the results of the business projection for the province of Imbabura calculated in Table 2, we have an estimate of 62,479 companies for the year 2018, which served as the universe for the study. Subsequently, the sample size was calculated using the following statistical formula:

$$n = \frac{P.Q.N}{(N-1)\left[\frac{E^2}{K^2}\right]+P.Q} \qquad (3)$$

Where:
n= sample size
N= population size (62,479 enterprises)
P= probability that the event will occur (0.5) or 50%
Q= probability that the event will not occur (0.5) or 50%.
E= 0.05 or 5%. Maximum error allowed.
K= 1.96. For which the level of confidence is 95%.

$$n = \frac{62{,}479 \times 0.5 \times 0.5}{\left[(62{,}479 - 1)\left(\frac{0.05^2}{1.96^2}\right)\right]+(0.5 \times 0.5)}, \; n = 381.92 \cong 382 \text{ inquiries}$$

For the present research, the concepts of Corporate Social Responsibility embodied in the ISO 26000 standard were taken as a reference, considering the variables in Table 4.

Variable	Dimension	Type	Scale	Question
Active Participation and Community Development	Active Participation In The Community	Quantitative	Nominal	Consultation of community representative groups to determine priorities for social investment and community development activities.
		Quantitative	Nominal	Delegate a representative to participate in local association meetings as far as possible and appropriate, with the aim of contributing to the public good and community development objectives.
	Education and culture	Quantitative	Nominal	Promotes and supports education and/or culture at all levels, engaging in actions that improve the quality of and access to education, promoting local and cultural knowledge.
	Social investment	Quantitative	Nominal	Takes into account the promotion of community development when planning social investment projects.
		Quantitative	Nominal	Avoids actions that perpetuate the community's dependence on the organization's philanthropic activities, continued presence or support.

Table 4: Operative variables

c. Procedure for collecting information

Once the sample size was calculated, multiple stages probabilistic sampling was chosen, with a random selection of primary units (cantons), secondary units (parishes) and final units (persons).

In the first stage, the sample calculated by main activity was divided according to ISIC. It was then distributed by cantons, parishes, and neighborhoods in proportion to the cadastre of each canton.

In the second stage, a simple sample of the businesses identified in the parishes of each of the six cantons that make up the province of Imbabura was selected.

In the next stage, according to the sectors selected, the number of companies established in the distribution table of the sample was applied through a random procedure, counting each umpteenth time, if the sector warranted it. In case of rejection, inexistence or inaccuracy of the addresses of the companies, or other impediments to carry out the survey, the selected company was replaced, following the random procedure of each umpteenth time.

Finally, the fourth stage consisted in applying the survey to the final units. The companies surveyed were selected according to their proximity to the business sectors at random in both the urban and rural sectors, through an appropriate allocation table for each canton. A filter was applied to the chosen respondent to find out if they live in the sector, otherwise the survey was completed.

d. Procedure for the validation of the research instrument.

The validity of the content was carried out through the judgment of experts, applying the Delphi method, carrying it out in three phases: a) selection and construction of the instruments to be evaluated; b) selection of the experts, applying a coefficient of competence of the expert and; c) validation of the instrument. The consultation was carried out to five experts with Master's degree in Administration and Business, three of them reached a qualification of 0.8875 over 1 on the performance in the values of the competence coefficient to study, analyze, give valid and reliable criteria on the elaborated work.

In this section, the results obtained are presented and explained as evidence of exploratory work carried out through a descriptive analysis of the active participation and development of the community as part of its social responsibility practices, in contrast to execution.

The first step was to verify the existence of active participation and community development of the units of study in each of the cantons of the province. We verified that the companies have integrated in their planning and as part of their business philosophy, concepts that have to do with their social responsibility.

The second step was to establish the workers and managers' perception about how much they know about the active participation and development whether it was implemented with respect to the principles of corporate social responsibility.

The results obtained from the cantons under study present a lack of knowledge on the part of workers and managers about the active participation and development of the community as part of their practices of social responsibility, with high negative percentages (83%), with the exception of the business sector of the canton Cotacachi and Pimampiro, who answered affirmatively (76%) to know on the active participation and development of the community as part of their practices of social responsibility, however their strategies are focused more on care for the environment, which can be explained by the mining boom.

In the third stage, it was determined how many companies were executing what they had determined about corporate social responsibility.

Based on the obtained results, (23), when evaluating the number of companies that execute the determined about corporate social responsibility, in the cantons of the province, where it has been verified that these companies have integrated in their planning and as part of their corporate philosophy, concepts that have to do with their social responsibility, in particular because they know the importance they have in socially responsible participation in the community.

The procedure used to assess every company performance is the following:

1. Every expert select one linguistic term from Table 1 to assess company performance for every one of the companies. Their equivalent SVNNs are used for calculation.
2. For each company (index j), the mean of its five experts' evaluation (index i) is calculated, using the formula $E_j = \langle \frac{\sum_{i=1}^{5} T_{ij}}{5}, \frac{\sum_{i=1}^{5} I_{ij}}{5}, \frac{\sum_{i=1}^{5} F_{ij}}{5} \rangle$, j = 1, 2, …, 382. Then, E_j is the new neutrosophic assessment for company j.
3. The Shapiro-Wilk normality test is applied to the set of truth values for every E_j, which is a useful test that contributes to prove that the data obtained, adjust to a Normal distribution. The result was that the normality hypothesis is not rejected with p = 0.27462.
4. We consider the following Neutrosophic Hypothesis problem:

$NH_0: \mu_T \in [0, 0.5)$
$NH_a: \mu_T > 0.5$, where μ_T is the sample mean of the truth value for every E_j, i.e., we calculate if it is statically significant that the assessment of every company is under Average, according to Table 1.

We obtained do not reject the neutrosophic null hypothesis with a maximum p = 0.5949. Therefore, the result is that the assessment is less than Average.

From what can be seen, that the business sector is not executing the programmed activities in relation to what was planned in social responsibility.

These results can be explained from different theories that provide various points of view such as the instrumental theory that refers to the study of social activities that allow to fulfill the purpose of creating entrepreneurial wealth, which implies that companies will develop socially responsible actions if they are linked for obtaining higher levels of profitability for both owners and shareholders [21].

According to [2], philanthropic contributions must be made by shareholders, owners or employees, as an independent decision to the company. The author stresses that business organizations have been created exclusively to generate profits and obtain maximum profitability for shareholders, following an ethic that respects the laws and regulations that regulate the economic activities of companies.

Friedman in [2] also states that socially responsible activities are works of charity, while for business owners it is an unfair and costly burden that they should not assume and which further deprives them of the freedom and capacity to decide for themselves, as to what to do with their utilities and to whom to allocate them. It even mentions that contributing through the payment of taxes already constitutes fulfilling the development of the community and that the administration of such funds is the responsibility of the central government.

On the other hand, it can be explained by Williamson's Theory of Transaction Costs (1975), which states that the primary purpose of the economic institutions of capitalism is to economize transaction costs; which from the outset proposes a challenge to be studied from the perspective of law, economics and organization, if one considers that these -the economic institutions of capitalism-, have not occupied a place of relevance in social science research, perhaps because of their inherent complexity, or perhaps because of the lack of agreement regarding the main purposes of economic organization [22].

Companies do not actively participate in the community because of the consequences of the Agency Theory explained in [23], where he states that, according to the company, agency theory is a kind of legal artifice that serves as a nexus to a series of contractual interactions called agency relationships. The agency relationship is one in which the owners of the capital (principal) and the directors (agents) interact, in an explicit or implicit contract by which they commit themselves to carry out a business activity. According to [24], in effect, the company is conceived as a team whose members act to satisfy their own interests, but who are aware that their future depends on the survival capacity of their team in the process of concurrence with other organizational work teams that would allow a greater production with a minimum expenditure of human effort and the technical and economic resources committed [25]. Therefore, it is likely that shareholders have socially responsible intentions, but that managers do not apply them with the objective of maximizing company profits.

4 Conclusions

It was evident that the activities of a company affect the environment in which they operate, the degree will depend on the type of industry, however, it is important that they are responsible for their actions and actively participate in the search for solutions together with the community.

It is necessary that companies materialize the theory in active participation and community development, which is framed with socially responsible responsibility and which is not well accepted among the entrepreneurs of the province for now.

It should be considered that there is a requirement for greater commitment on the part of entrepreneurs to integrate concepts of sustainability in their strategies, which will allow them to generate trust and commitment with the communities in which they develop their commercial activities.

On the other hand, it requires consideration of social responsibility that incorporates sociological aspects that are related to the social and economic dynamics of a sector and responds to cultural, educational and emotional trends. It is important to establish that entrepreneurs respond to social dynamics by developing strategies as contingents in response to these factors.

The social investment is conditioned to factors of capacity and resources reason why the entrepreneurs from Imbabura, prefer to elaborate strategies to respond contingently to factors that can be imposed by the social tendency, or cultural of the moment in which the citizenship lives.

In order to demonstrate the significance of the active participation of companies in the community, a study was carried out in the six groups (cantons), which have different characteristics, for which neutrosophic

statistics were used, on the basis of which it was detected that the active participation of companies in the community is not positive due to the fact that entrepreneurs do not see economic opportunities based on theories such as risk and appropriation through which they consider that investing in the community does not generate any economic value.

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Received: January 25, 2019. Accepted: May 10, 2019

Neutrosophic statistics methods applied to demonstrate the extra-contractual liability of the state from the Administrative Organic Code

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Abstract. In the present work, a conceptualization was made on an exploratory model, which is explanatory of the requirements established by the General Organic Code of Processes, for the configuration of the extra-contractual liability of the State, emphasizing the qualified damage. Neutrosophic statistics are used to demonstrate the state's extra-contractual liability from the administrative organic code, deducing three main functions within the determination of liability, among which are the function of patrimonial reparation, the preventive function and the control function. The conclusion is that qualified damage is understood as that public burden unbalanced on an administered due to deficient state action, which leads to a patrimonial and moral reparation.

Keywords: Qualified damage, extra-contractual liability, public charges, legitimate interest, neutrosophic statistics.

1 Introduction

The non-contractual responsibility of the State is a system of meanings understood as a general principle of public law, a constitutional duty of the State in the exercise of any public function, a subjective public right of force, constitutional rank or value, a constitutional guarantee belonging to the individual or administered, a member of any democratic and judicial society, to demand through administrative or judicial channels the compensation of damages, material and moral, caused in their legal situation, subjective right and legitimate interest or current legal interest or in their movable or immovable property attributable to the normal or abnormal functioning of the entities and organs of the State [1].

The State is not liable for damages suffered by the contractor when these come from acts or facts that are beyond its actions or omissions, so the contracting public entity is not obliged to compensate all damages. The use of justified measures in the financial imbalance of the state contract has become so widespread that it has produced unfair and excessive situations for the State, which are contrary to the principles governing the state contract. The rigor has been reduced to define the unpredictable ones, accepting inflation and the variation of climatic conditions, and it is therefore suggested that the assumptions that make up the financial imbalance of the state contract be defined in legislation, particularly those linked to acts or facts committed by the state, see [2]. According to studies carried out in [3], individual and collective responsibility is derived from social progress, and the declaration of nature as a subject of law in Ecuador has become a new paradigm of South American legal sciences.

The Constitution of the Republic of Ecuador presents Ecuador as a Social State governed by the rule of law, which establishes as principles the protection of fundamental rights, respect for human dignity, work, solidarity and the prevalence of the general interest; in addition to promoting the realization of rights, such as food, housing, education, health, social security, among others. The interpretation of the meanings of the non-contractual responsibility of the State therefore has a field of eminently juridical character.

With regard to non-contractual liability for pecuniary or moral damages attributable to the State corresponds to one of the most important areas for Administrative Law, seen from a perspective it is the limit to the exercise of State power since its owners must act subject to the law; and, as a guarantee for administered citizens that their rights will be respected as long as the violation and damages caused by the State entails compensation.

The change of paradigm from the civil criterion to a constitutional one, regarding the extra-contractual liability of the state in Ecuador in effect as of July 7, 2018 through the Organic Administrative Code, raises the legal rank of sentences and normative bodies that have been previously applied unifying the criteria for these parameters, [4].

This study deals with the extra-contractual liability of the State, which, since its incorporation as an institution of this branch of Law, has been studied from different perspectives and points of view by various legislations. Although its study has not been taken to the daily arena, its importance does not diminish, [5]. It is an authentic factor of transformation, and therefore, depending on the proposed purpose, it will help to build a society with certain characteristics [6].

To speak of state responsibility implies getting involved in the relationship of the State with third parties, where one could witness in a certain way the irresponsibility through the essential obligations maintained by the State. Such as responsibly satisfying the collective needs of the social conglomerate, with a vision where the care of the public interest is above all its actions, for which a model is presented as an objective that involves the factors that intervene in the extra-contractual responsibility of the State from the Organic Administrative Code.

According to the previous analysis, the use of neutrosophic statistics is required to demonstrate the extra-contractual liability of the state from the administrative organic code. With the use of classical statistics, the data are known, formed by clear numbers. In the neutrosophic statistics the data have certain indetermination, the data can be ambiguous, vague, imprecise, incomplete, even unknown. Instead of sharp numbers used in classical statistics, sets (which approximate these sharp numbers respectively) are used in neutrosophic statistics [7].

In addition, the cited author refers that in neutrosophic statistics, the sample size may not be known exactly (for example, the sample size may be between 90 and 100); this may occur because, for example, the statistician is not sure what approximately they refer to, which are the individuals in the sample, whether or not they belong to the population of interest, or because the individuals in the sample only belong partially to the population of interest, while do not belong partially. Another approach would be to consider only partially the data provided by individuals in the sample whose membership in the population of interest is only partial.

This study makes use of neutrosophic hypotheses, where the distinction between the classical (statistical) hypothesis and the neutrosophic hypothesis according to [7], is that in the neutrosophic statistics the variables that describe the characteristics of the population are neutrosophic, have indeterminate values or several unknown values, or an inaccurate number of terms if the variable is discrete, or for values that we compare at least one of the characteristics of the population is neutrosophic, i.e., indeterminate or uncertain or of vague value.

Smarandache in [7] refers that, similarly to classical statistics, a Neutrosophic Null Hypothesis, denoted by NH_0, is the assertion that it is initially assumed to be true. While the Alternative Neutrosophic Hypothesis, denoted by NH_a, is the other hypothesis. When testing NH_0 against NH_a, there are two possible conclusions: reject NH_0 (if the sample evidence clearly suggests NH_0 is false), or do not reject NH_0 (if the sample does not support the chain evidence against NH_0).

This paper is divided in a section of Materials and Methods, where some basic methods of neutrosophic theory and neutrosophic statistics are summarized. These methods are used to calculate the results in the section of Results and Discussions. The last section is devoted to conclude this paper.

2 Materials and Methods

A documentary review is applied to verify the role of the state in contractual responsibility. The working methodology focuses on an exploratory-explicative model, based on the extra-contractual responsibility of the State, by means of which strategies are applied for the compilation of primary sources, such as the compilation of literature and other key informants, as well as secondary sources such as existing statistical registers and other public and private thematic publications.

This type of model entails activities and tasks that make it possible to obtain and relate different types and levels of information that result in significant outcomes and are linked to the proposed objectives.

Likewise, the model is based on shared academic and transfer activities between the teacher in charge of the Project, students and intermediate organizations that participate directly and others that are added at the time of translating the objectives into activities.

In this sense, the importance and dynamics of the model applied is highlighted insofar as it proposes

strategies of joint, interrelated and interdisciplinary work between the different actors involved in this type of Project, whose dynamics extends beyond the University itself as an inherent attribute.

In the following some basic concepts of Neutrosophy theory are summarized.

The original definition of truth value in neutrosophic logic is shown in [8], where it is defined in Definitions 1 and 2.

Definition 1 Let *X* be a universe of discourse, a space of points (objects) and *x* denotes a generic element of *X*. A *neutrosophic set A* in *X* is characterized by a truth-membership function $T_A(x)$, an indeterminacy-membership function $I_A(x)$, and a falsity-membership function $F_A(x)$. Where, $T_A(x)$, $I_A(x)$, $F_A(x) \subseteq]^-0, 1^+[$, i.e., they are real standard or nonstandard subsets of the interval $]^-0, 1^+[$. These functions do not satisfy any restriction, that is to say, the following inequalities hold:

$^-0 \leq \inf T_A(x) + \inf I_A(x) + \inf F_A(x) \leq \sup T_A(x) + \sup I_A(x) + \sup F_A(x) \leq 3^+$.

Definition 2 Let *X* be a universe of discourse, a space of points (objects) and *x* denotes a generic element of *X*. A *Single Valued Neutrosophic Set* (SVNS) *A* in *X* is characterized by a truth-membership function $T_A(x)$, an indeterminacy-membership function $I_A(x)$, and a falsity-membership function $F_A(x)$. Where, $T_A(x)$, $I_A(x)$, $F_A(x)$: $X \rightarrow [0, 1]$ such that: $0 \leq T_A(x) + I_A(x) + F_A(x) \leq 3$. A *single valued neutrosophic number* (SVNN) is symbolized by <T,I,F> for convenience, where T, I, F $\in$ [0, 1] and $0 \leq$ T+ I+ F$\leq$3.

Therefore, $A = \{\langle x, T_A(x), I_A(x), F_A(x)\rangle : x \in X\}$ or more simply $A = \langle T_A(x), I_A(x), F_A(x)\rangle$, for every $x \in X$.

Given *A* and *B* two SVNSs, they satisfy the following relationships:

7. $A \subseteq B$ if and only if $T_A(x) \leq T_B(x)$, $I_A(x) \geq I_B(x)$ and $F_A(x) \geq F_B(x)$. Particularly, $A = B$ if and only if $A \subseteq B$ and $B \subseteq A$.
8. $A \cup B = \langle \max(T_A(x), T_B(x)), \min(I_A(x), I_B(x)), \min(F_A(x), F_B(x))\rangle$, for every x$\in$X.
9. $A \cap B = \langle \min(T_A(x), T_B(x)), \max(I_A(x), I_B(x)), \max(F_A(x), F_B(x))\rangle$, for every x$\in$X.

Some important concepts of Neutrosophic Statistics are the following:

A *neutrosophic population* is a population where the membership of the individuals is not well defined and a level of indeterminacy could exist.

A *neutrosophic sample* is a sample where indeterminacy is in some way present.

The origin of indeterminacy can be due to the partial appurtenance of its members or because of the indeterminacy of this subset as a whole.

Example 1 One example of neutrosophic data is following: {1, [1, 3], [2, 4], 3, 4, [3, 4), (1, 2], (0, 1), {1, 2, 3}}. See that some data are imprecise like [1, 3] and {1, 2, 3}, because the exact datum is not known. In the framework of a neutrosophic sample, we can also have an imprecise sample size.

In Neutrosophic Statistics it is important to calculate with interval-valued operations, thus, in the following some of them are summarized. Let $I_1 = [a, b]$ and $I_2 = [c, d]$ be two real valued intervals, then, see [9]:

9. $I_1 \leq I_2$ if and only if $a \leq c$ and $b \leq d$.
10. $I_1 + I_2 = [a+c, b+d]$.
11. $I_1 - I_2 = [a-d, b-c]$.
12. $I_1.I_2 = [\min(ac, ad, bc, bd), \max(ac, ad, bc, bd)]$.
13. $1/I_1 = [1/b, 1/a]$, always that $0 \notin I_1$.
14. $I_1/I_2 = I_1.(1/I_2)$.
15. $\sqrt{I_1} = [\sqrt{a}, \sqrt{b}]$, if and only if $a \geq 0$.
16. $I_1^n = \underbrace{I_1 \cdot I_1 \cdot \cdots \cdot I_1}_{\text{n times}}$, $n \in \mathbb{N}$.

Definition 3 A *Neutrosophic Normal Distribution* is a normal distribution of the random variable X, where either the median μ or the variance σ^2 (standard deviation σ) or both of them are imprecise.

A *neutrosophic hypothesis* satisfies that the statistics of the variables used to describe the population characteristics are neutrosophic or at least one value which describes a population characteristic is neutrosophic.

The *Neutrosophic Null Hypothesis*, denoted by NH_0, is the one which we have to prove it is true; also, the *Neutrosophic Alternative Hypothesis* is defined and denoted as NH_a.

Example 2 Neutrosophic hypotheses can be the following:

$$\begin{cases} NH_0: \mu \in [1, 3] \\ NH_a: \mu > 3 \end{cases}, \begin{cases} NH_0: \mu \in [1, 3] \\ NH_a: \mu < 3 \end{cases} \text{ or } \begin{cases} NH_0: \mu \in [1, 3] \\ NH_a: \mu \notin [1, 3] \end{cases}$$

There exists two neutrosophic type of errors, they are:

3. A *Neutrosophic Type I Error*, is the error of rejecting NH_0 when NH_0 is true.
4. A *Neutrosophic Type II Error*, is the error of not rejecting NH_0 when NH_0 is false.

A *Neutrosophic Level of Significance* α can be a set, in this framework α can be defined like an interval.

Definition 4 A *Neutrosophic P-Value* p is the smallest level of significance such that NH_0 is rejected. See that the Neutrosophic P-Value is not necessarily a crisp value.

Definition 5 The limits of the *Neutrosophic Confidence Interval for the Population Mean* μ is calculated with Equation 1.

$$\bar{x} \pm z_{\text{critical value}} \cdot \frac{\hat{S}}{\sqrt{n}} \quad (1)$$

Where n is the sample size, which can be an interval, α is the neutrosophic level of significance, $\hat{S}$ is the sample standard deviation and $\bar{x}$ is the sample mean.

Other distributions are defined as usual, see [10, 11, 12, 13]. Moreover, the hypothesis test can be naturally extended to neutrosophic hypothesis test. Also, a test of normality can be applied, taking into account the new definitions.

A formula to calculate the statistically representative sample size is given in Equation 2.

$$n = \frac{k^2 Npq}{e^2(N-1)+k^2 pq} \quad (2)$$

Where:

n= sample size

N= population size.

p = probability that the event will occur (0.5).

q = probability that the event will not occur (0.5).

e = 0.05 or 5%. Maximum error accepted.

k = 1.96. For which the level of confidence is 95%.

Linguistic terms can be associated to SVNNs according to Table 1, defined in [14].

Linguistic Term	SVNN
Extremely good (EG)	(1,0,0)
Very very good (VVG)	(0.9, 0.1, 0.1)
Very good (VG)	(0.8,0.15,0.20)
Good(G)	(0.70,0.25,0.30)
Medium good (MDG)	(0.60,0.35,0.40)
Average(M)	(0.50,0.50,0.50)
Medium Bad (MDB)	(0.40,0.65,0.60)
Bad (B)	(0.30,0.75,0.70)
Very bad (VB)	(0.20,0.85,0.80)
Very very bad (VVB)	(0.10,0.90,0.90)
Extremely bad (EB)	(0,1,1)

Table 1: Linguistic terms and the associated SVNN

With the purpose of facilitating practical application to decision-making problems, the proposal was made for the use of single-value neutrosophic sets [8] (SVNS), through which it is possible to use linguistic terms [15], in order to obtain a greater interpretability of the results obtained with this type of data.

The SVNN in Table 1 can be ranked by using the scoring function defined in [16], see Equation 3.

$$s(M) = 2 + T - F - I \quad (3)$$

Where M = (T, F, I) is a SVNN. Let us observe that $s: [0,1]^3 \to [0,\ 3]$.

Thus, the proposed procedure is the following:

1. A poll is designed based on the interviewed' answers given in form of linguistic terms, like in Table 1. The closed question consists in: "How do you evaluate the application of the extra-contractual liability of the state from the administrative organic code in Ecuador?" where the possible answers are given in Table 1. The number of interviewed is calculated by using Equation 2. A random sample with this sample size is collected.
2. Each linguistic term of the sample is associated to a SVNN, according to Table 1.
3. The score function is evaluated for every one of the SVNNs of the step 2, using Equation 3.
4. The real-valued numbers obtained in step 3 are used like an equivalent sample.
5. A test of normality is applied to the new sample.
6. The following neutrosophic hypothesis problem is calculated, given that the sample distributes normally:

$NH_0: \mu \in [1.5, 3]$

$NH_a: \mu < 1.5$

That is to say, we have a null hypothesis which means that the population's opinion is at least an Average (M), whereas the alternative hypothesis means that it is less than Average or Bad.

Then, there exist two possible interpretations:

6.1. To non reject H_0 means that the population's opinion is qualified like at least Average.

6.2. To reject H_0 means that the population's opinion is qualified in the range from "Extremely bad" to "Medium bad".

3 Results and Discussions

The number of lawyers in Ecuador is estimated in approximately N = 21,460. Then, calculating with Equation 2, we have n = 377.42 ≈ 378 is a significant sample size.

The question of the poll was asked to 378 lawyers randomly selected and interviewed personally or by cell phone.

The Kolmogorov-smirnov nonparametric test was applied to determine if the distribution of the sample is normal; however, the normality null hypothesis is rejected. Because of the sample size is much bigger than 30, the normality or quasi-normality was assumed.

The sample mean was $\bar{x} = 0.80675$ and the sample standard deviation was $\hat{s} = 0.47625$.

Then, $z = \frac{\bar{x}-\mu}{\left(\hat{s}/\sqrt{n}\right)} = \frac{[0.80675, 0.80675]-[1.5,3]}{\left(0.47625/\sqrt{378}\right)} = [-89.534,\ -28.301]$. Thus, z << -1.96, i.e., NH_0 is rejected.

The sample mean is the closest to s(0.3, 0.75, 0.7) = 0.85, therefore the final result can be qualified like more or less "Bad".

In this context, after conducting the relevant analysis of the State's tort liability, there exists agreement with the authors' point of view [17, 18], which coincides with the affirmation of the obligation of the public administration to repair the damage caused to one of its administered, which was not in the legal duty to bear it. It is with the evolution of the theory of state liability that this type of obligation is also applicable under administrative law, which makes it possible to demand from the administration patrimonial liability through compensation for the damages it may cause to those administered [5].

Based on the foregoing, it is identified that the non-contractual liability of the Public Administration has three main functions, which contribute to the non-contractual liability of the state from the administrative organic code, these three functions are:

1. The Administration's patrimonial responsibility has as its primary function the reparation of damages to the administered, by reason of the administrative turn or traffic.

2. Preventive function, due to the fact that, together with other instruments such as criminal or disciplinary liability, the responsibility of the Administration serves to dissuade the public power and its officials, taking into account that in case of eventual damage, compensation must be sought [17].

3. Control function, which is directly related to the preventive function. This control function is exercised by the administrator by verifying the proper functioning of public services [18].

Within responsibility, the emphasis is also placed on public services within Administrative Law, as an obligation, that is, as a responsibility that the State has, with the national conglomerate [19]. In this sense, proactivity plays a fundamental role because it is a basic value in which it is incumbent upon them to guide and direct the destinies of certain activities, a futuristic and visionary construct [20].

4 Conclusions

It is demonstrated that the extra-contractual liability of the state is the proper guarantee of rights, whether for lack or deficient provision of public services or for actions or omissions in the exercise of public powers, the public servant is liable for violating the law, as well as for excess or defect in the performance of its activity. This means that in his (her) decisions he (she) cannot be reflected at his (her) whim or desire, but rather the realization of legal values. For which the Right through postulates and principles looks for justice and equality in a fair way, making reference to the ends that are the object of this Science.

On the other hand, emphasis is placed on Administrative Law, as the branch of law that seeks to frame the activity of the State within a legal order under the responsibility of which it guarantees and norm, this protects the coexistence of people and their goods, that is to say it provides security to its associates.

In the same way it is detected that it is the state that has sense and legitimate reason to be, before the deficient rendering of public services that cause damages, those that have the obligation to assume the reparation of the damage caused, by its officials in the exercise of the state activity. Therefore, it is concluded that the extra-contractual liability of the State is the limit to the exercise of state power that guarantees the rights of citizens against actions or omissions on the part of the State, thereby generating the

obligation of the State to repair the injured citizen.

The extra-contractual liability demands the fulfillment of three requirements of which the configuration of the qualified damage understood as that unbalanced public burden on an administered one due to the deficient state action stands out, which leads to a patrimonial reparation and of being the moral case.

The neutrosophic statistical hypothesis was used to demonstrate the significance of the extra-contractual liability that the Public Administration possesses when making use of the three main functions, on the basis of which it was detected that an adequate action is necessary as regards the control function, which is directly related to the preventive function.

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Received: January 9, 2019 Accepted: May 15, 2019

Validation of the proof reversal on the inexistence of untimely dismissal by using neutrosophic IADOV technique

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Abstract. This paper aims to validate the reversal of the burden of proof regarding the non-existence of untimely dismissal, given that in the workplace the worker is considered the weakest part of the labor relationship and untimely dismissal is a social problem in Ecuador, for which compensation has been determined in legal regulations, provided that it has been voluntarily recognized or proven in a legal process, with the plaintiff (ex-worker) being the party obliged to prove such assertion, which is complicated by the circumstances in which a dismissal is made. Theoretical and empirical methods were used to obtain results that revealed the most frequent causes of the problem under study. To support the validation, survey instruments were applied that evaluated by means of a methodology, which integrates the IADOV method and the neutrosophic logic, the transcendence of the reversal of the burden of proof on the non-existence of untimely dismissal in Ecuador.

Keywords: Labor Law, untimely dismissal, burden of proof, labor conflict, IADOV method, neutrosophic logic.

1 Introduction

The "International Labor Organization" (ILO) was created in 1919. It is a tripartite body made up of representatives of governments, employers and workers whose mission is to promote labor rights and improve social protection, among others [1].

Throughout the history of law, we find that, for example, in Roman law there existed the legal principle that the assertion in court by the plaintiff, without further ado, puts the aggrieved or defendant before the obligation to exculpate or demonstrate the contrary to what the plaintiff argued, characterizing those elementary principles that we know today as procedural burdens [2]. Further on, Justinian, in relation to the evidence, makes a deeper analysis and indicates that together with the direct evidence the contrary evidence is formed, which has the purpose of disputing the results of the first [3].

It should be noted that from the beginning of the Law there were already several points about who bears the burden of proof, which may raise the question, whether the burden of proof should be generalized in the Law or whether it should be adapted to the specialties of the Law and therefore to what each one regulates.

According to the issue of November 13, 2016 of the newspaper *El Comercio*, a publication entitled "Untimely dismissal is the most common complaint in the courts," it is determined that the rate of dismissals in Ecuador is very high [4]. However, that is not the problem, since what is really worrying is the difficulty that the worker has in proving such illegal termination of the labor relationship as Contreras Gallo points out [5].

According to Ecuador's current regulations [6], it is the worker who must prove the existence of untimely dismissal in a labor lawsuit, for which he finds a limitation in obtaining evidence to justify this, given the particularities in which it occurs, being generally in the company's facilities, in a reserved manner, and if there are witnesses, it is the same workers of the employer who refuse to give their testimony because their job stability is at stake.

Ecuador's Labor Code provides for an indemnity that the employer must pay to its worker in the event of untimely dismissal [7]. The purpose of this compensation is to pay off for the damage caused and allow the worker to have certain resources while a new source of income is sought for him or her and him or her family [8]. Moreover, in order to access this compensation, the employer must first recognize the existence of the untimely dismissal or the worker must prove it, which, as mentioned above, is very complex.

It is important to analyze that the way in which the burden of proof in cases of untimely dismissal is established in the current legislation not only violates labor rights, but also the rights of persons belonging to priority care groups (persons with disabilities - pregnant women, among others) recognized in the Constitution of the Republic

of Ecuador [9] to whom the State has the obligation to give special and preferential attention, especially if they are in conditions of double vulnerability. Thus, if any of them is the victim of an untimely dismissal, they must first prove this assertion in order to access the benefits of an ineffective dismissal action, the objective of which is to guarantee the reinforced job stability of a person associated with a specific condition (pregnant woman/union leader) is diminished by the difficulty they would have in proving it with the limited body of evidence available to them. Hence, this is the reason of the great relevance of providing a solution to this social problem through law as a legal norm [10].

The benefits determined in the Organic Law on Disabilities [11] in favor of persons with disabilities in order to guarantee greater job stability due to their specific condition, is previously subject to the possibility that the former worker may prove the unjustified/untimely dismissal to which he or she was subjected, a "sine qua non" requirement for the aforementioned rule to be effective, a situation that, as stated above, is very complex given the particularity in which the dismissal occurs. According to what is referred to in [12], it can be verified directly in one's own experience or in the direct observation of others. This is the reason why it is analyzed as a model.

At the international level, there are countries in Latin America that already have a reversal of the burden of proof in cases of untimely dismissal in their legislation, such is the case of Bolivia, where the Article 66 of the Labor Procedural Code establishes that, in all lawsuits initiated by the worker, the burden of proof rests with the employer, without prejudice to the employer being able to offer the evidence it deems appropriate [13], and even in the Article 48 of its Political Constitution, it is determined that one of the principles under which labor norms shall be interpreted and applied is the principle of inversion of evidence in favor of the worker.

Considering the above, the question arises as to whether the burden of proof should be generalized in law or whether it should be adapted to the specialties of law. In this regard, the author Percy Chocano Núñez points out that the burden of proof does not correspond to who affirms a fact, but to who is in the best position to prove [14].

For this reason, a validation of the reversal of the burden of proof on the non-existence of untimely dismissal is carried out, for which Iadov's neutrosophic technique is applied, see [15]. These techniques constitute an indirect way to measure the reversal of the burden of proof on the non-existence of untimely dismissal.

This technique consists, as the original method states, in related criteria of answers to interspersed questions whose relation the subject does not know, at the same time the unrelated or complementary questions serve as introduction and support of objectivity to the respondent who uses them to locate himself and contrast the answers.

The result of these questions interacts through what is called "Iadov's Logical Table", in this work the satisfaction of the respondents is combined with the introduction of the neutrosophic estimation to seek a solution to the problems of indetermination that appear universally in the evaluations of the surveys and other instruments, taking advantage not only of the found and opposite positions but also of the neutral or ambiguous ones. Starting from the fact that every idea < A > tends to be neutralized, diminished, balanced by the ideas, in clear rupture with the doctrines binaries in the explanation and comprehension of the phenomena.

This is a Multicriteria Decision Making problem, a kind of problems that have been previously studied in the neutrosophic framework in papers like for example [16, 17, 18, 19].

This paper is divided in the following sections; Section 2 is dedicated to introduce theories and data that shall be used throughout this paper. Section 3 is devoted to calculate and analyze the results. In Section 4 we draw the conclusions of the paper.

2 Materials and methods

In relation to empirical data collection methods were used, for which the Judiciary Council of Santo Domingo was asked the number of processes of untimely dismissal that have entered from January 2017 to December 2017 and in how many of those processes the Judge has ruled in favor of the worker granting compensation for untimely dismissal, such information to assess its impact on the judicial environment and therefore in society, thus achieving an idea of the magnitude of the phenomenon studied; As well as direct observation when attending hearings and indirect observation when studying various processes in relation to the subject matter; and expert judgment through the interview technique, which were directed to two legal professionals, one is a lawyer in the free exercise of his profession and a professor at the Universidad Regional Autónoma de los Andes UNIANDES extension Santo Domingo, and the other one is a current Public Defender of Santo Domingo and former labor inspector, an interview guide is used.

Another of the techniques used was the survey, for which a sample of 21 subjects was considered, among the labor inspectors, defenders and lawyers in the free exercise of the profession of Santo Domingo. The survey was elaborated with five questions, three closed-ended questions interspersed in two open-ended questions; of which one fulfills the introductory function and three functioned as a reaffirmation and support of objectivity to the respondent.

The questionnaire used in the survey was useful to measure the reversal of the burden of proof on the non-existence of untimely dismissal; to anticipate, design and measure the impact of the problem, five questions were taken into account, three of them closed and two open. The three closed-ended questions correspond to the "Iadov Logical Table", which is presented adapted to the present research and shown in Table 1.

	1. Would it be appropriate to dispense with the reversal of the burden of proof on the non-existence of untimely dismissal?								
	No			I don't know			Yes		
3. Does the application of analysis to measure the reversal of the burden of proof over the non-existence of untimely dismissal meet your expectations?	2. If you could choose freely, an option to measure the inversion of the burden of proof over the non-existence of untimely unplanning would you choose one with similar characteristics to those of Ecuador?								
	Yes	I don't know	No	Yes	I don't know	No	Yes	I don't know	No
Very satisfied.	1	2	6	2	2	6	6	6	6
Partially satisfied.	2	2	3	2	3	3	6	3	6
I don't care.	3	3	3	3	3	3	3	3	3
More unsatisfied than satisfied.	6	3	6	3	4	4	3	4	4
Not at all satisfied.	6	6	6	6	4	4	6	4	5
I don't know what to say.	2	3	6	3	3	3	6	3	4

Table 1: Logical table by V.A. Iadov to measure the reversal of the burden of proof on the non-existence of untimely dismissal. Source Own preparation.

The number resulting from the interrelation of the three questions indicates the position of each respondent in the satisfaction scale, that is, their individual satisfaction.

As for the quantitative evaluation of results, neutrosophy theory is applied. Some basic concepts of this theory used in this paper are next summarized, see [20].

Definition 1 Let X be a universe of discourse, a space of points (objects) and x denotes a generic element of X. A *neutrosophic set* A in X is characterized by a truth-membership function $T_A(x)$, an indeterminacy-membership function $I_A(x)$, and a falsity-membership function $F_A(x)$. Where, $T_A(x)$, $I_A(x)$, $F_A(x) \subseteq]^-0, 1^+[$, i.e., they are real standard or nonstandard subsets of the interval $]^-0, 1^+[$. These functions do not satisfy any restriction, that is to say, the following inequalities hold:

$^-0 \leq \inf T_A(x) + \inf I_A(x) + \inf F_A(x) \leq \sup T_A(x) + \sup I_A(x) + \sup F_A(x) \leq 3^+$.

Definition 2 Let X be a universe of discourse, a space of points (objects) and x denotes a generic element of X. A *Single Valued Neutrosophic Set* (SVNS) A in X is characterized by a truth-membership function $T_A(x)$, an indeterminacy-membership function $I_A(x)$, and a falsity-membership function $F_A(x)$. Where, $T_A(x)$, $I_A(x)$, $F_A(x)$: $X \rightarrow [0, 1]$ such that: $0 \leq T_A(x) + I_A(x) + F_A(x) \leq 3$. A *single valued neutrosophic number* (SVNN) is symbolized by <T,I,F> for convenience, where T, I, F $\in [0, 1]$ and $0 \leq T + I + F \leq 3$.

Therefore, $A = \{\langle x, T_A(x), I_A(x), F_A(x)\rangle : x \in X\}$ or more straightforwardly $A = \langle T_A(x), I_A(x), F_A(x)\rangle$, for every $x \in X$.

Given A and B two SVNSs, they satisfy the following relationships:

10. $A \subseteq B$ if and only if $T_A(x) \leq T_B(x)$, $I_A(x) \geq I_B(x)$ and $F_A(x) \geq F_B(x)$. Particularly, $A = B$ if and only if $A \subseteq B$ and $B \subseteq A$.
11. $A \cup B = \langle \max(T_A(x), T_B(x)), \min(I_A(x), I_B(x)), \min(F_A(x), F_B(x))\rangle$, for every $x \in X$.
12. $A \cap B = \langle \min(T_A(x), T_B(x)), \max(I_A(x), I_B(x)), \max(F_A(x), F_B(x))\rangle$, for every $x \in X$.

In order to analyze the results, a scoring function is established. An adapted scoring function [21] is used to sort the alternatives, see Equation 1.

$$s(a_j) = 2 + T_j - F_j - I_j \quad (1)$$

Here a_j is an alternative evaluated with the SVNN (T_j, I_j, F_j). Let us note that $s: [0, 1]^3 \rightarrow [0, 3]$.

The definition of precision function is given in Equation 2.

$$a(a_j) = T_j - F_j \quad (2)$$

$a: [0, 1]^3 \rightarrow [-1, 1]$.

Here we prefer Equation 2 for scoring the options according to precision.

Based on the aforementioned concepts, the individual satisfaction scale shown in Table 2 was used to measure the individual satisfaction of each respondent associated to a linguistic term, see [22]. Observe that the scores are slightly different to them used in [15].

Number	Expression	SVNN	Score (Precision function)
1	Clear satisfaction	(1, 0, 0)	1
2	More satisfied than dissatisfied	(1, 0.25, 0.25)	0.75
3	Not defined	(0.5, 0.5, 0.5)	0
4	More dissatisfied than satisfied	(0.25, 0.25, 1)	-0.75
5	Clear dissatisfaction	(0,0,1)	-1
6	Contradictory	(1,0,1)	0

Table 2: Individual satisfaction scale.

This technique also includes the solution of a multicriteria decision making problem, see [23]. Multicriteria Decision Making is a decision making process where the number of criteria to evaluate is more than one, whereas, a Group Decision problem consists in a decision problem where the number of Decision Makers is more than one.

The usual fuzzy operators utilized to solve Group Decision problems are the aggregation operators. This notion can be extended to the neutrosophic framework. Neutrosophic Aggregation Operators are formally defined in Definition 3.

Definition 3 Let X be a universe of discourse, a space of points (objects) and x denotes a generic element of X. $\boldsymbol{A}$ is a *Single Valued Neutrosophic Aggregation Operator* (SVNAO) if it is a mapping $\boldsymbol{A}$: $\cup_{n\in\mathbb{N}}\ ([0,1]^3)^n \rightarrow [0,1]^3$.

One example of SVNAO is the *Weighted Average* operator (WA), which is shown in Equation 3.

$$WA(a_1, a_2, \cdots, a_n) = \sum_{i=1}^{n} w_i a_i \qquad (3)$$

Where, $a_i = (T_i, I_i, F_i)$ are SVNNs and $w_i \in [0, 1]$ for every i = 1, 2, …, n; which satisfy the condition $\sum_{i=1}^{n} w_i = 1$. The a_is are the values obtained for the i^{th} alternative assessment, and w_i denote the weight which represents the importance given to the alternative a_i.

The Weighted Average operator was used in [15] like an index of agreement, it was called Group Satisfaction Index (GSI).

Summarizing, the proposed neutrosophic IADOV technique consists in the following steps:

1. Each interviewed person emits his or her criterion for every of the three closed questions, according to Table 1. The only three possible answers for questions 1 and 2 are either, Yes, I don't know or No. The third question has six possible answers, namely, "Very satisfied", "Partially satisfied", "I don't care", "More unsatisfied than satisfied", "Not at all satisfied" and "I don't know what to say".
2. For each triplet of answers given by each interviewed, one answer per question, a number in Table 1 is taken from the intersection cell, with values ranged from 1 to 6.
3. The number obtained in the previous step is selected in the first column of the Table 2. It is associated to its corresponding SVNN, in the second column of the table.
4. Every person's opinion is associated to an importance weight, $w_i \in [0, 1]$ for every i = 1, 2, …, n; which satisfy the condition $\sum_{i=1}^{n} w_i = 1$. This step is necessary when the opinion is emitted by experts and the expertise level will be taking into account. Otherwise, it is recommendable to assume $w_i = \frac{1}{n}$ for every i = 1, …, n.
5. The person's opinions are aggregated using the Weighted Average operator defined in Equation 3, it is the GSI.
6. Calculate a(GSI).
7. Calculate the closest score to a(GSI) from those appeared in the last column of Table 2. When a(GSI) is equally closest to two different values, the selection is made by means of the score function given in Equation 1.
8. In case that the final score is 0, which means not defined or contradiction, the final criterion is obtained from the answers given to the open questions.

3 Results

As for the information requested from the Judiciary Council of Santo Domingo, it was obtained that during the period spanned from January 2017 to December 2017, eighty-five claims for compensation for untimely dismissal were filed, of which nine are with a sentence only one of them could prove untimely dismissal.

As for the analysis of labor lawsuits, in the case of ineffective dismissal processed in the Judicial Unit of Civil, Commercial and Labor of the canton of Santo Domingo, it is determined that the plaintiff (breastfeeding woman) did not obtain a ruling in her favor because the existence of the untimely dismissal cannot be proved.

In the interviews, several questions were asked to legal professionals; however, it is considered that the relevant questions for the subject matter of this research work are the following:

1. Do you think that there should be a reversal of the burden of proof towards the employer regarding the non-

existence of untimely dismissal?

- Dr. Liber Andrade: "Of course, it has to exist, because we do not forget that the worker is the weak part of the labor relationship, and in this case, as much as there have been workers who heard that the employer fired their co-worker, they are not going to want to go and declare in favor of the worker, because job stability is going to be at stake...".

- Lawyer Jonathan Vera: "This escapes from the common rule, in the field of law it is established that whoever affirms a fact must prove it, this is typical of the labor field because of the inequality within this legal relationship between the parties ... and it would be very important to give this situation of the reversal of the evidence in favor of the worker ...".

2. Do you believe that the employer's rights would be violated by proposing to reverse the burden of proof in the absence of untimely dismissal?

- Dr. Liber Andrade: "In no way, because in the country we must understand that worker-employer relations are covered by social law, and the principles that govern social law, is that, always when there is a weak relationship and a strong relationship, the strong relationship is the one that has to be tested...".

- Lawyer Jonathan Vera: "No. Rather what one would be doing is forcing the employer to do things the right way and to begin to do much more orderly with the acts and... to seek respect for the rights that workers have...".

The result of applying the IADOV technique to the criteria in the survey to measure the reversal of the burden of proof on the non-existence of untimely dismissal is shown in Table 3.

Expression	Total	%
Clear Satisfaction	14	66
More satisfied than dissatisfied	7	33
Not defined	0	0
More dissatisfied than satisfied	0	0
Clear dissatisfaction	0	0
Contradictory	0	0

Table 3: Results of the application of the IADOV technique to measure the reversal of the burden of proof on the non-existence of untimely dismissal.

The score is calculated and Iadov's calculation is determined, for our case study a value was assigned in the equal weights vector $w_1 = w_2 = \cdots = w_{21} = 0.0476$. The result of the method is GSI = (1.00, 0.083, 0.083), a(GSI) = 0.91667, which is closest to 1, meaning "Clear Satisfaction", and showing a high level of group satisfaction.

The result obtained denotes clarity of what is expressed in the judicial processes, regarding that each former worker who claims compensation for untimely dismissal must present the reversal of the burden of proof. That is to say, who should prove that there was no unilateral and illegal form of termination of the labor relationship should be the employer, but not the worker. Consequently, if the employer is unable to prove this, the judge will consider the worker's statement and his respective indemnification payment to be true and proven.

Additionally, the result obtained demonstrates that the implementation of the inversion of the burden of proof does not violate the rights of the employer since it must be understood that worker-employer relations are covered by social law and its principles.

From the research carried out (surveys, interviews, among others), it was determined that there is a need to implement the reversal of the burden of proof on the non-existence of untimely dismissal, a novel situation taking into consideration that it would be applied in a general manner and not only when the employer alleges abandonment of the worker. All of which strengthens and contributes to workers' fair access to the compensations and benefits determined by legal regulations, when such illegal and unilateral termination of the labor relationship occurs.

4 Conclusions

Ecuadorian law indicates that the burden of proof for the existence of untimely dismissal generally falls on the plaintiff (ex-worker) who has the burden of proving the facts he has affirmatively proposed in the complaint and who has denied the plaintiff in his reply.

According to Ecuadorian jurisprudence, the reversal of the burden of proof in untimely dismissal only occurs when the former employer in answer to the complaint indicates that it was the worker who left his job.

Surveys and interviews conducted with legal professionals, as well as the analysis of judicial processes in labor matters, show that it is necessary to implement the reversal of the burden of proof on the non-existence of untimely dismissal in order to strengthen and allow workers fair access to the compensation and benefits determined by legal regulations when such illegal and unilateral termination of the labor relationship occurs, preventing the employer from taking advantage of the difficulty and lack of evidence that the former worker has, for which the

Article 169 of the General Organic Code of Processes should be reformed.

The validation process using Iadov's neutrosophic technique to measure the reversal of the burden of proof on the non-existence of untimely dismissal confirmed its feasibility of use. The results were expressed quantitatively in a high index of satisfaction of the group in the survey applied in our case study.

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Received: January 18, 2019. Accepted: May 8, 2019

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Compensatory fuzzy logic model for impact assessment when implementing ICT in pedagogical scenarios

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Abstract. A Pedagogical Scenario is the place where different events take place and serves as an essential framework for the teaching-learning process. It is the space organized and structured in such a way that facilitates access to knowledge, through the generation of activities and relationships that motivate learning. Pedagogical scenarios can be designed or predicted. The aim of this article is to evaluate the impact of the implementation of Information and Communication Technologies (ICT) in pedagogical scenarios, using compensatory fuzzy logic. The compensatory fuzzy logic has operators of conjunction, disjunction, negation among others that facilitate the solution of problems because it allows mathematically modeling the experience of experts in natural language and on the other hand it allows to decide which is the most convenient evaluated scenario.

Keywords: Compensatory Fuzzy Logic, pedagogical scenarios, ICT, mathematical operators, natural language

1 Introduction

Today's higher education is related to the education, training and preparation of man/woman for life from a social constructivist point of view, as well as the training of professionals capable of facing the challenges and transformations that are manifested today in the different branches of science and who are responsible for solving the problems that arise in the sphere of production and services. In this sense, the new pedagogical scenarios that are presented in the current educational system play a fundamental role[1], as are the technologies that have transformed the current learning environment and influenced the traditional process of teaching educators under a new dynamic, updated and innovative practice of university education [2].

Pedagogical scenarios today require a preparation in terms of technology, especially in computing and communication, to achieve satisfactory results in the training of professional skills. To achieve this objective, it is necessary to face an essential problem that lies in the preparation of students according to the performance of their work as a professional future, for which it is essential to appropriate an accumulation of skills that will allow them to face with quality the productive process, which has as a precedent an undergraduate training in tune with current transformations and that is materially evidenced in the conception of solutions with quality and scientifically justified.

With regard to pedagogical scenarios and, in particular, educational models according to, it defines them according to the transversal content that the educational models should have in themselves, and especially the teachings present in all parts of the curriculum of the different educational phases, that is, common themes to all the areas directed to the integral formation of the student and to the preparation of the same to be integrated into society. In the document itself, the author refers to transversal contents in education and specifically those related to training in the use of new information and communication technologies.

In the development of educational theories and models, of pedagogical scenarios that promote the creation of learning environments and communities supported by Information and Communication Technologies (ICT), important efforts have been made, which have included guidelines for the design, implementation and evaluation of educational materials, didactic units, activities and learning objects mainly applied to education mediated by technology, in this sense when in daily coexistence there are inadequate patterns in human behavior, it is necessary to unlearn incorrect patterns, reconstruct the pieces of behavior and relearn other patterns of new learning as in the case of information and communication technology [3].

Today's knowledge society, driven by scientific progress in a globalizing socioeconomic framework and sustained by the widespread use of diverse information and communication technologies, brings about changes that affect all areas of human activity. These effects are manifested in a general way in work activities and in the world of education, the way of teaching and learning, the infrastructures and means we use for this, the organizational structure of centers in general and schools in particular based on their culture.

Based on the foregoing, it should be noted that it is necessary to introduce ICT in pedagogical scenarios, to strengthen the teaching-learning process so that its presence in the system does not constitute a factor of addiction and dependence. In this context[4], they identify difficulties in introducing ICTs in the pedagogical environment and in turn in the new cultural context, highlighting the presence of technocratic, reformist and holistic pedagogical scenarios.

Regardless of the difficulties in introducing ICTs into educational environments, as in other fields of human activity, their use, as referred to [5], has social, economic or political consequences, but different from one culture to another. Therefore, this transformation of implementing technology into a useful and applicable environment is a process that has to be carried out both on a social and institutional level, as well as on a personal level, in order to seek and find that real utility that technology can bring as an added value in the teaching-learning process.

The use of ICT in pedagogical environments becomes an indispensable tool, where they can perform multiple functionalities, however, in pedagogical environments where the use of ICT constitutes a threat the functionalities to be performed are lower, but the tendency to technology addiction is also lower.

In accordance with the above, this study evaluates pedagogical scenarios in higher education, using compensatory fuzzy logic, in order to support decision-making regarding the impact of the implementation of ICTs in the pedagogical scenarios of higher education.

The analysis carried out leads to the risk of addiction to technology in students. To this end, the level of learning obtained in students must be observed, with the use of technology and without its use. The corresponding results give an account of academic performance, which is a factor to be taken into account in this evaluation.

In order to obtain measurable results, all categories of ratios of the teaching-learning process, whether or not ICTs are implemented in pedagogical scenarios, should be used to appreciate the impact of this process. The lack of generic indicators that demonstrate the impact of the pedagogical scenarios, before and after applying ICT, becomes a barely confusing problem in the teaching-learning process, which makes it difficult to evaluate the pedagogical scenarios of higher education efficiently.

Faced with the situation described and with the use of traditional techniques to measure the impact of implementing ICT, it is not possible to obtain an adequate evaluation, since traditional techniques do not provide an appropriate solution, sometimes the information obtained with such techniques is imprecise or missing, a situation that needs to be resolved with other advanced techniques, such as the use of Compensatory Fuzzy Logic, this technique deals more solidly with linguistic terms and in particular the use of mathematical logic operators. It provides linguistic models that express, through logical propositions, the translation of ambiguous phrases in a colloquial style as they refer to[6] .

2. Preliminaries

In this section, we briefly review compensatory fuzzy logic concept. Afterwards, we present compensatory fuzzy logic operators.

2.1 Compensatory Fuzzy Logic

Compensatory Logic is a favorable field of application for decision support applications, with a high practical capacity. It composes a new multivalent system, which breaks with traditional Mathematics, in order to achieve a better semantic behavior than that of classical systems [7, 8].

Essentially, Compensatory Fuzzy Logic has among its properties, that it is sensitive to changes in the basic predicates, interpretable according to categorical scales of truthfulness, it contributes to the compensation of the values of the basic predicates with others, it is not associative [9]. It offers new operations to implement logical operators, among others: conjunction and disjunction, which facilitate a logical system of simultaneous modeling in the deductive and decision-making processes, since it simultaneously takes into account statements that may be contradictory. [10]

Compensatory Fuzzy logic offers a suitable working scheme that combines the advantage of implementing uncertain concepts with the possibility of handling sentences in natural language [11]. The modeling of vagueness is achieved through linguistic variables, which allows to take advantage of the knowledge of experts. The linguistic variables in Compensatory Logic have their foundation from the linguistic terms that are obtained, in the present work the foundation to be used with linguistic terms is based on the values of truth and their respective categories, this are shown in Table 1.

Truth value	Category

0	False
0.1	Almost false
0.2	Pretty fake.
0.3	Something false
0.4	More false than true
0.5	As true as false
0.6	More true than false
0.7	Something real
0.8	Quite true
0.9	Almost true
1	True

Table 1: Values of truth

2.2 Compensatory Fuzzy logic Operators

A Compensatory Fuzzy Logic system is a quartet of operators: a conjunction, a disjunction, a negation and a strict fuzzy order that satisfies the axioms of compensation, commutativity, strict growth, veto, fuzzy reciprocity, fuzzy transitivity and the Morgan's law [12].

In this work Geometric Mean Based Compensatory Logic (GBCFL) is used due to the robustness and relative simplicity of its main operators [13].

In GBCFL conjunction is defined as follows:

$$c(x_1, x_2, \dots, x_n) = (x_1 x_2, \dots, x_n)^{\frac{1}{n}} \quad (1)$$

Disjunction is defined as the dual of the conjunction:

$$d(x_1, x_2, \dots, x_n) = 1 - [(1 - x_1)(1 - x_2) \dots (1 - x_n)]^{\frac{1}{n}} \quad (2)$$

The fuzzy negation defined as is:

$$n(x) = 1 - x \quad (3)$$

and the fuzzy strict order is:

$$o(x, y) = 0.5[c(x) - c(y)] + 0.5 \quad (4)$$

With compensatory fuzzy logic we can express an "appealing" sensibility and attaint more reliable operators according to the way that human make decisions in real world [14].

2.0 Model for impact assessment when implementing ICT in pedagogical scenarios

The model for impact assessment when implementing ICT in pedagogical scenarios, supported by compensatory fuzzy logic, follows the steps shown in Figure 1.

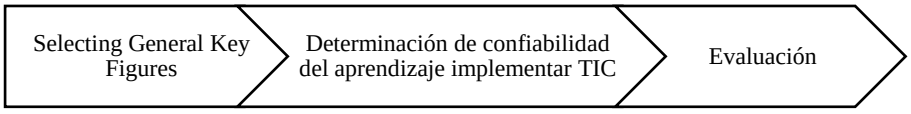

Figure 1: Stages of the model for the evaluation of the impact of the implementation of ICT in pedagogical scenarios, supported by the compensatory fuzzy logic. Source Prepared by the authors

The detailed description of each of the steps of the model are:

a. Stage of selection of the general key figures; all the key figures are specified with express indication of their calculation form and the range of the final results (absolute or relative as appropriate). For this purpose, a selection of ratios from a series of available indicators is made, in which the forms of calculation and their interpretation are made explicit. It is based on a previous analysis, which consists of hierarchical segmentation, based on the search for relevant factors that contributes to the identification of the variables that have the greatest impact on the

classification of pedagogical environments, through the use of data mining techniques [14].

b. Stage of determining the reliability of learning, when implementing ICT, in pedagogical scenarios; indicators are selected to measure the reliability of learning, when implementing ICT, in pedagogical scenarios. Then, the propositional form of each predicate that intervenes in learning is detailed, by implementing ICT in pedagogical scenarios, which facilitates determining the reliability of learning with the use of technology.

c. Evaluation stage: The academic results are taken from a student cohort that has incorporated the use of ICT into the curriculum, and compared against another student cohort that has not incorporated ICT into the curriculum; the evaluation is carried out according to the rank of promotion indicator. For their score, the value of the promotion indicator is labeled.[15]

3 Results

According to the stages proposed in the model represented in Figure 1, the following results are obtained:

a. Stage of selection of the general ratios

At this stage the indicators are separated into four groups to be measured, they are:

- General indicators of the teaching-learning process
- Indicators specific to learning using ICTs
- Indicators of knowledge management with the use of ICTs
- Reliability of the knowledge managed with the use of ICTs

The defined indicators have been classified according to the students' learning when using ICT, standing out:

- The availability of skills for access to information and for the use of any technological resource.
- Cognitive abilities to transform information into knowledge.
- Ability to use languages and expressive forms to relate and disseminate information through any medium and communicate with other subjects.
- Interiorization of criteria and values for the ethical use of information and knowledge.

The student cohorts have been classified according to their professional competence. The groups to be measured are ordered according to the future decisions of the students' professional development. The groups A, correspond to the competences still unknown (A: Unknown), those corresponding to group C, are the students prepared to work in entities or companies; (C: Entities), those of group E, are the students who wish to work freely; (E: Free) and those of group O, are the students who wish to work in public institutions; (O: Public).

The ratios obtain rank that are calculated, with express determination of the reported data, according to the promotion variable in student cohorts. They are expressed in percent. Table 2 shows the indicators to measure the reliability of learning, when implementing ICT, in pedagogical scenarios.

Code	First name	Values
R1	Type of activity	Availability of skills for access to information and for the use of any technological resource, cognitive abilities to transform information into knowledge, ability to use languages and expressive forms to relate and disseminate information through any medium and communicate with other subjects. Interiorization of criteria and values for the ethical use of information and knowledge.
General indicators of the teaching-learning process		
R2	Percentage of total promotion	[0;1]
R3	Number of suspensions	[1;8844]
Indicadores propios del aprendizaje al utilizar TIC		
R4	ICTs as components of institutional culture	[0,38;88,74]
R5	Availability to involve the ICT in the formative task of the students	[18,86;884,46]
R6	Availability for the strengthening of technology and research habit through its insertion	[17,36;909,51]
R7	Investments in relation to the insertion of ICT in the teaching-learning process	[3,04;99,07]

R8	Surplus capital required to insert ICT in the teaching-learning process	[-10,34;778,01]
R9	Availability in relation to enforceable commitments of educational institutions to insert ICTs in the teaching and learning process	[1,09;958,65]
	Indicators of knowledge management with the use of ICTs	
R10	Knowledge management when using ICTs in relation to knowledge management without the use of ICTs	[-0,22;98,99]
R11	Unfavourable academic results in relation to the use of ICTs	[-269,6;283,29]
R12	Expenditure related to the teaching-learning process with ICT	[0;97,78]
R13	Expenses of Exploitation of technology in relation to the learning of the students	[1,2;687,39]
R14	Total expenditure related to the use of ICT in the teaching-learning process	[-0,22;785,17]
R15	Outcome in relation to the use of ICT in the teaching-learning process	[-651,66;554,43]
	Proposed indicator (Reliability of the knowledge managed with the use of ICT)	
R16	Reliability = Number of suspensions	[0,0000076;1,65]
R17	Difficulty = Difficulties with student cohorts in relation to the promotion of students with ICT insertion	[20,03;545,85]

Table 2: Range of key figures. Source Own preparation.

b. Stage of determining the reliability of learning by implementing ICT in pedagogical scenarios.

The indicators to measure the reliability of learning, when implementing ICT, in pedagogical scenarios are shown in Table 3, of these indicators is detailed its propositional form involved in the model

Criterion: Difficulty B(x)	
Difficulty index, B(x)	Quotient between students with difficulty in promoting and the technologies used
Criterion: Promotion C(x)	
Promotion index, C(x)	Quotient between quantity of promoted and technology used
Criterion: Financial solvency to insert ICT D(x)	
Financial solvency index to insert ICT composed by:	Quotient between students promoted when managing information and ICT used
a) Efficient ICT information management index, E(x)	Quotient between academic performance and ICT used
b) Favorability index of academic results in relation to ICT use, F (x)	Quotient between the indices of the promotion and ICT results used
c) Promotion results index, G(x)	Quotient between ICT employment availability and economic solvency
(d) Response capability index, H (x)	

Table 3: Selection of indicators of reliability of learning, when implementing ICT, in pedagogical scenarios. Source Prepared by the authors.

Detail of the predicates used:

A(x): x is a student cohort with ICT included that has a promotion and is considered reliable.

B(x): x has a low level of difficulty in learning with ICTs
C(x): x has a low level of promotion
D(x): x has financial solvency to insert ICTs
E(x): x has efficient ICT information management
F(x): x has unfavorable academic performance in relation to the use of ICTs
G(x): x has a good result in promotion results
H(x): x has a high responsiveness

The expressions fo g ICT, in pedagogical educational scenarios, t e experts, were defined by a group of experts s learning of pedagogical scenarios. The expressio

$A(x) = B(x) \wedge C(x)$

$D(x) = H(x) \vee [G(x$

Where a - H(x) is th ough the operator and ∨ performs the calculation

The proposed model cenarios is shown in Figure 2.

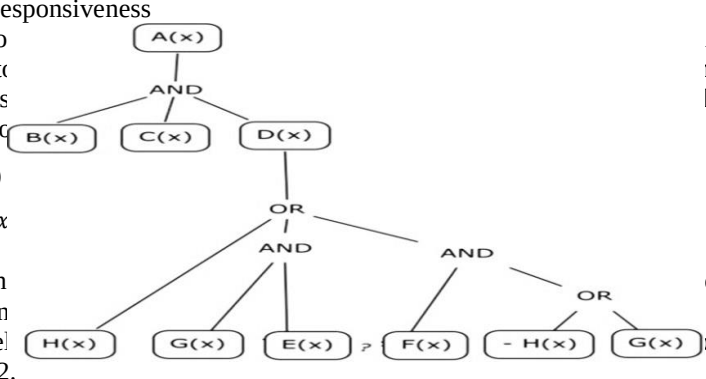

Figure 2: Proposed model for impact assessment when implementing ICT in pedagogical scenarios. Source Prepared by the authors.

Based on the model proposed for impact assessment when implementing ICT in pedagogical scenarios, the propositional form of each predicate involved in learning is detailed, when implementing ICT in pedagogical scenarios, which facilitates determining the reliability of learning with the use of technology.

Predicate D(x) corresponds to the sentence "The financial solvency to insert ICT is obtained through the high capacity of response, related to the good result in the promotion results and the efficient management of information with ICT, or of unfavorable academic results in relation to the use of ICT together with a low level of response or a high result in the promotion results" and implies the disjunction H(x) and other two compositions of predicates.

Predicate A(x) corresponds to the sentence "A student cohort with ICT included that has a good promotion is considered reliable if it has a low level of difficulty in learning with ICT, a low level of promotion and a good financial solvency to insert ICT" and implies conjunction of prepositions B(x), C(x) and D(x).

The linguistic labels defined in three levels, as the functions associated with the predicates of the ratios defined from the analysis of the graphical representation of the data were established as:

A(x)→ Student cohort with ICT included that has a promotion and is considered reliable has defined the linguistic scale: high, medium and low.

B(x)→ Difficulty in learning with ICT, has an associated function a sigmoidal membership function, through the scale: high, medium and low.

C(x)→ Promotion has a sigmoid function associated with it, using the following scale: high, medium and low.

D(x)→ Financial solvency to insert ICT, has defined the linguistic scale: high, medium and low.

E(x)→ Information management with efficient ICT, has an associated trapezoidal membership function, by means of the scale: very efficient, efficient and scarcely efficient.

F(x)→ Unfavorable academic results in relation to the use of ICT, has an associated trapezoidal membership function, through the following scale: high, medium and low.

G(x)→ Good result in promotion results, has an associated trapezoidal membership function, through the following scale: high, medium and low.

H(x)→ Response capacity, has a sigmoid membership function associated with it, by means of the following scale: very adequate, adequate and scarcely adequate.

They were not assigned membership functions[7] to the propositions of A(x) and D(x), because they are the result of the composition of other predicates, we worked with the labels according to the results obtained and the range of values they can take.

c. Evaluation stage

At this stage, they take the academic results of a student cohort that has incorporated the use of ICT into the curriculum, and compare it against another student cohort that has not incorporated ICT into the curriculum; the evaluation is carried out according to the rank of promotion indicator. For its score, the value of the promotion indicator is labeled. The results are shown in Table 4.

This type of analysis presents the value corresponding to the ratio that gives rise to the basic propositions [B(x), C(x),E(c),F(x),G(x) and H(x)] and the linguistic label corresponding to the proposed compensatory fuzzy model.

Criteria	**Predicted**	**Indicator value**	**Linguistic expression**	**Truth value according to Table1**
Difficulty	B(x): x has a low level of difficulty in learning with ICTs	0,1	Quite difficult	0.19
Promotion	C(x): x has a low level of promotion	0,04	Almost absolutely unsafe	0.11
Financial solvency to insert ICT D(x)	E(x): x has efficient ICT information management	283,72	More inefficient than efficient	0.41
	F(x): x has unfavorable academic performance in relation to the use of ICTs	-0,30	Average academic results	0.50
	G(x): x has good promotion results	-651,66	Absolutely bad.	0
	H (x): x has a high responsiveness	0	Almost absolutely unresponsive	0.10

Table 4: Analysis of the impact assessment model when implementing ICT in pedagogical scenarios. Source Prepared by the authors.

For the analysis of the results obtained in Table 4, the values of a given student cohort were taken, which gave a low reliability in the promotion results without inserting ICT, with which, in terms of this attribute, the result is quite insecure. Result obtained by calculating$A(x) = B(x) \wedge C(x) \wedge \{[H(x) \vee (G(x) \wedge E(x))] \vee [F(x) \wedge (-H(x) \vee G(x))]\}$, being obtained:

$A(x) = 0.2 \wedge 0.1 \wedge \{[0.1 \vee (0 \wedge 0.4)] \vee [0.5 \wedge (0.9 \vee 0)]\}$

$A(x) = 0.2 \wedge 0.1 \wedge [0.1 \vee 0 \vee (0.5 \wedge 0.684)]$

$A(x) = 0.2 \wedge 0.1 \wedge (0.1 \vee 0 \vee 0.585)$

$A(x) = 0.2 \wedge 0.1 \wedge 0.28$

$A(x) = 0.18\ (low\ reliability)$

This result shows that student cohorts with ICT insertion have high reliability in promotion results with respect to student cohorts without ICT insertion in their curriculum.

Conclusion

In order to measure the evaluation of the impact of the implementation of ICT in pedagogical scenarios, a relative study was carried out of the demand for preparation in terms of technology, especially in computer science and communication, which is needed in the educational system, in order to obtain a professional with greater preparation for professional performance.

The use of compensatory fuzzy logic is proposed to measure the linguistic terms of the evaluation of the impact of the pedagogical scenarios, given that in this technique the operators of human thought ( ) are better modeled with other probabilistic techniques.

A model was developed for the impact assessment of implementing ICT in pedagogical scenarios that consist of three stages, which were developed to then obtain the results of the model.

It is demonstrated through the proposed model, based on compensatory fuzzy logic, for evaluating the impact of implementing ICT in pedagogical scenarios, that these scenarios have greater reliability in learning than

pedagogical scenarios with student cohorts, which did not insert ICT in their curriculum. Future work will concentrate on developing a compensatory neutrosophic model.

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Received: January 11, 2019. Accepted: May 9, 2019

Neutrosophic model for the analysis of criminal behaviour in Quevedo, Ecuador, from a spatial econometric analysis

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Abstract. The environments of poverty, marginalization, overcrowding, lack of resources and opportunities are influential factors in the behavior of individuals. The externalities, evaluated from the context and their influence on criminal behavior, are the object of study of the legal sciences. This research process leads the authors to determine dimensions and indicators in order to assess the effectiveness of the legal system, from sources manifested in material reality. Poverty is a contingent phenomenon, built on social inequality that affects the actions of the individual and that the law cannot ignore given its connotation and conditioning capacity and in particular because the phenomenon of poverty constitutes a fundamental factor in the criminal behavior of citizens. For this reason, the objective of this paper is to analyze the criminal behavior achieved in Quevedo, Ecuador, based on the use of spatial econometric techniques and the use of Neutrosophy, which are useful for the evaluation of the impact of the indicators of greater incidence on the criminal behavior achieved in the aforementioned region.

Keywords: Violence, crime, citizen security, development problems, poverty, spatial econometrics and neutrosophic logic

1 Introduction

In the essay written in 1849, "Wage labor and capital," [1] Karl Marx warned of the relative essence of poverty and well-being, pointing out that: "A house can be big or small; as long as the surrounding houses are equally small, it satisfies all the social demands of a dwelling. However, if a palace arises next to the little house, the little house is reduced to a hut [2]. Needs and pleasures arise from society; this is measurable by society and not by the objects of its satisfaction, because they are of a social character and of a relative nature.

The increase in crime rates and violence is the main problem that afflicts Ecuador, over and above issues such as unemployment and the economic crisis. This behavior on an international scale is the matrix that continues to remain intact in the region.

Studies on citizen security show that these problems have the same relevance as the inequity, poverty and unemployment of the 1970s [3]. The problem of citizen security represents one of the fundamental axes within the policy managed by the Ecuadorian administration.

One of the findings that is frequently presented and that mark problems of formulation in the local policies of Ecuador are those related to poverty. Expressed as a social and economic situation, characterized by a marked lack of satisfaction of basic needs[4].

The notion of poverty expresses situations of lack of economic resources or living conditions that society considers basic in accordance with social reference standards that reflect minimum social rights and public objectives. These norms are expressed in absolute and relative terms, which are variables over time and in different national spaces [4].

Absolute poverty is linked to the situation in which a person or a household is poor given its own situation of dissatisfaction with a set of needs and opportunities, or the lack of a minimum level of income or expenditure to ensure the satisfaction of those needs. Relative poverty is related to the fact that a person is poor when being in a

situation of clear economic and social disadvantage in relation to the rest of the people around him, this is affirmed [5] when he mentions that poverty is a contingent and socially constructed phenomenon, and that it varies according to societies and time.

Another finding considered to support the effective formulation of local public policies is economic development and the use of endogenous resources. According to [6], they are classified as a conception conceived from a process of structural deficit, which has its origins in decolonization.

A significant element is the demography that characterizes the city of Quevedo, Ecuador, where the relationship of rural, urban and semi-urban contexts stands out, and which constitute dimensions to analyze in order to support the effective formulation of local public policies. Its peri-urban and rural components, fed by rural-urban migration, are important elements to be taken into account in the formulation of public policies.

Rural poverty is exacerbated because certain groups are excluded from the fruits of productivity and employment growth, applicable to all economies, regardless of levels of development). This new perspective of analysis focused on causal assessment made it possible to identify some relevant aspects with a social impact.

The progress of these phenomena leads to other impact factors associated with the deterioration of the quality of life, such as urban settlement, pollution, stratification of wealth and malnutrition. Malnutrition is reflected in areas of extreme poverty, where inadequate and scarce food is notorious.

According to [7], malnutrition caused by a lack of economic income causes the death of children, due to a lack of resources, lack of public strategies and increased population growth. This is why Ecuadorians resort to migration, which is a notorious consequence of inadequate management of social and economic resources that generates poverty and in turn has a significant impact on delinquency.

With regard to the well-being of the different social groups in the city of Quevedo, Ecuador, it should be noted that most of the inhabitants are salaried workers, and few are the families that have an income from their own highly profitable activity. In accordance with the foregoing and based on the legal concept of salary, which groups together economic factors of individual income or gain, and constitutes a fundamental link in the analysis of criminal behavior in the city of Quevedo, Ecuador, salary is highlighted judiciously as the patrimonial advantage received as compensation for subordinate work.

Unemployment is a social reality faced by Ecuadorian families. It is considered as a factor of inclusion and integration in the society of which it is a part, of which it becomes a disintegrating factor; that reinforces marginality and exclusion, and is linked to the indices of delinquency present in Quevedo, Ecuador.

The aforementioned results are part of the documentary analysis carried out to find the aspects with the greatest incidence of crime in the city of Quevedo, Ecuador. Derived from this documentary analysis, it is corroborated that the city of Quevedo, Ecuador, has high rates of violence, all of which corresponds with the expression of the weak social, economic, political structure achieved by this society.

Based on the aforementioned, the technique of spatial econometrics is used for the analysis of the criminal behavior achieved by the society of Quevedo Ecuador, as an expression of the social, economic and political structure achieved by society, given the increase in insecurity that exists in each locality. The technique of spatial econometrics, is a discipline of general econometrics, which includes the set of techniques of specification, estimation, contrast and predictions necessary for the treatment of the data of a locality, in particular spatial data.

Refers [8], that econometrics can also be defined as the part dealing with the treatment of spatial interaction (spatial autocorrelation) and spatial structure (spatial heterogeneity) in cross-sectional and data regression models. Analyses based on spatial econometrics are similar to analyses carried out with Geostatistics or Spatial Statistics, which is used by physicists and geographers, according to the aforementioned author.

For the analysis based on spatial econometrics, we first consider the results that are made through empirical econometrics, which begins with the specification of a number of economic relationships (given in quantitative form). Subsequently, the variables involved and the functional forms that relate them are analyzed, as well as the results obtained with the theoretical models, which are used to obtain spatial data, normally of a micro-territorial scope, which do not exist, and which is what is known as spatial prediction[9].

In order to identify the incidence of the socioeconomic variables that have greater repercussion, for the analysis of the criminal behavior reached by the society of Quevedo Ecuador, an evaluation of such situation is made through the spatial econometric. The information analyzed comes from a documentary analysis of the communities with the highest incidence of crime and poverty in the Quevedo Ecuador region.

The results obtained when making use of spatial econometrics are later treated through a Neutrosophic model, useful for the treatment of the information obtained in linguistic terms. The use of Neutrosophy contributes to decrease the uncertainty, treat the data and obtain from them a greater interpretability.

2 Preliminaries

2.1 Neutrosophy

Neutrosophy is a new branch of philosophy that, according to [11], studies the origin, nature and scope of neutrality, as well as its interactions with different ideational spectra, where (A) is an idea, proposition, theory, event, concept or entity; anti (A) is the opposite of (A); and (neut-A) means neither (A) nor anti (A), that is, the neutrality between the two extremes [12]. Etymologically neutrosophic [Frances neutre < Latin neuter, neutral, and Greek sophia, knowledge] means knowledge of neutral thoughts and began in 1995.

His fundamental theory states that every idea <A> tends to be neutralized, diminished, balaced by <noA> ideas (not just <antiA> as Hegel posed) in a state of equilibrium. <noA> = what is not <A>, <antiA> = the opposite of <A>, and <neutA> = what is not <A> or <antiA>. In their classical form <A>, <neutA>, <antiA> are disjointed two by two. As in several cases the boundaries between concepts are vague to imprecise, it is possible that <A>, <neutA>, <antiA> (and <nonA> of course) have common parts.

The original of truth value in neutrosophic logic is shown in [10]:

Definition 1 Let X be a universe of discourse, a space of points (objects) and x denotes a generic element of X. A *neutrosophic set A* in X is characterized by a truth-membership function $T_A(x)$, an indeterminacy-membership function $I_A(x)$, and a falsity-membership function $F_A(x)$. Where, $T_A(x)$, $I_A(x)$, $F_A(x) \subseteq]^-0, 1^+[$, i.e., they are real standard or nonstandard subsets of the interval $]^-0, 1^+[$. These functions do not satisfy any restriction, that is to say, the following inequalities hold:

$^-0 \leq \inf T_A(x) + \inf I_A(x) + \inf F_A(x) \leq \sup T_A(x) + \sup I_A(x) + \sup F_A(x) \leq 3^+$.

This theory has formed the basis for neutrosophic logic [11], neutrosophic sets[12] , neutrosophic probability, neutrosophic statistics and multiple practical applications [13]. For this reason it is used in the present investigation, from the spatial econometric analysis, which is carried out, to recommend which are the factors of greater incidence in criminal behavior in Quevedo, Ecuador.

2.2 Single valued neutrosophic numbers

Let X be a universe of discourse. A single valued neutrosophic set A over X is an object having the form [14] :

$$A = \{\langle x, u(x), rA(x), vA(x)\rangle : x \in X\} \quad (1)$$

where $u_A(x): X \rightarrow [0,1]$, $r_A(x), : X \rightarrow [0,1]$ and $v_A(x): X \rightarrow [0,1]$ with $0 \leq u_A(x) + r_A(x) + v_A(x) :\leq 3$ for all $x \in X$. The intervals $u_A(x)$, $r_A(x)$ y $v_A(x)$ denote the truth- membership degree, the indeterminacy-membership degree and the falsity membership degree of x to A, respectively.
Single valued neutrosophic numbers (SVN number) is denoted by $A = (a,b,c)$, where $a,b,c \in [0,1]$ and $a+b+c \leq 3$.
In decision analysis schema aggregation operating are important for rating options. Some aggregation operators have been proposed for SVN numbers. Single valued neutrosophic weighted averaging (SVNWA) aggregation operator [15]:

$$F_w(A_1, A_2, \dots, A_n) = \langle 1 - \prod_{j=1}^{n} \left(1 - T_{A_j}(x)\right)^{w_j}, \prod_{j=1}^{n} \left(I_{A_j}(x)\right)^{w_j}, \prod_{j=1}^{n} \left(F_{A_j}(x)\right)^{w_j} \rangle \quad (2)$$

The aggregation of information consists of the process of combining different data providing a single output. Aggregation operators are a type of mathematical function used for the purpose of merging information. They combine n values in a domain D and return a value in that same domain [16].

3 Materials and methods

Documentary analysis was carried out, in particular of information materials to obtain information on criminal behaviour in Quevedo, Ecuador. The technique of spatial econometrics was used to identify the incidence of the socioeconomic variables that have the greatest impact on the criminal behavior achieved by the society of Quevedo Ecuador. The results obtained are qualitative, which are interpreted through the use of Neutrosophy, particularly through the use of models based on the aggregation of information.

The workflow of the aggregation model in this research is shown in Figure 1.

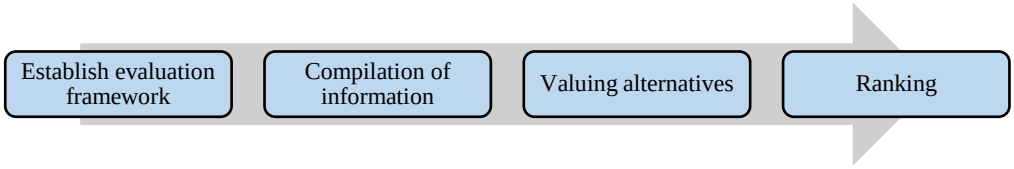

Figure 1: Neutrosophic model based on the aggregation of information for the analysis of criminal behavior in Quevedo, Ecuador.

To evaluate the results of the model proposed in Figure 1, the linguistic terms with their respective single-value neutrosophic numbers (SVNs) [11, 12] are used, as shown in Table 1. SVNs based on aggregation of information are expressed as A = (a,b,c), which are represented by tuples.

Linguistic term	SVN Number
Extremely good (EG)	(1,0,0)
Very very good (VVG)	(0.9, 0.1, 0.1)
Very good (VG)	(0.8,0.15,0.20)
Good (G)	(0.70,0.25,0.30)
Medium good (MDG)	(0.60,0.35,0.40)
Average (M)	(0.50,0.50,0.50)
Medium Bad (MDB)	(0.40,0.65,0.60)
Bad (B)	(0.30,0.75,0.70)
Very bad (VB)	(0.20,0.85,0.80)
Very very bad (VVB)	(0.10,0.90,0.90)
Extremely bad (EB)	(0,1,1)

Table 1: Linguistic terms used [17].

The detailed description of each activity in the proposed model (Figure 1), for the analysis of criminal behavior in Quevedo, Ecuador is:

Phase 1. Establish an evaluation framework, where the criteria and alternatives to be evaluated are selected in order to prioritize the latter. The framework is defined as follows:

- $C = \{c1, c2, \dots, cn\}$ with $n \geq 2$, a set of criteria
- $E = \{e1, e2, \dots, ek\}$ with $k \geq 1$, a set of experts
- $X = \{x1, x2, \dots, xm\}$ with $m \geq 2$, a finite set of alternatives

Phase 2. Information gathering, is the phase where information is obtained about the preferences of decision makers. The utility vector [13] is represented as follows:

$Pj=\{p_{j1}, p_{j2},\dots,p_{jk}\}$, where p_{jk} is the preference in relation to the criterion c_k of the alternative x_j

Phase 3. Valuing the alternatives, in this phase the alternative is constructed where the aggregation operators are used.

Phase 4. Ranking, phase where the alternatives are classified, to choose the most convenient through the scoring function that is applied. In accordance with the scoring and accuracy functions for SVN sets, a ranking order is generated for the set of alternatives [17] and then the option(s) with the highest scores is selected.

A scoring function defined by is used to rank alternatives:

$$s(Vj) = 2 + Tj - Fj - Ij \quad (3)$$

In addition, the precision function is defined as follows:

$$(Vj) = Tj - Fj \quad (4)$$

and then:

If s(Vj) < s(Vi), then Vj is less than Vi, denoted as Vj < Vi. In case of s(Vj)= s(Vi). If (Vj) < a(Vi), then Vj is less Vi, denoted by Vj < Vi. If a(Vj)= a(Vi), then Vj and Vi are equal, denoted by Vj= Vi. The ranking is carried out according to the scoring function of the evaluated alternatives.

4 Case Study

In order to apply the spatial econometric technique, an estimation model was carried out that made it possible to identify the incidence of the socioeconomic variables with the greatest incidence on criminal behavior in Quevedo, Ecuador. The estimation model was generally represented as; $y_i = f\ (poverty\ conditions_i, \text{checks}, \mathcal{E}_i)$.. Where; i represents the jurisdiction, the indicator witnessing problems (poverty, weight indicator) and Ɛ is the end of the random disturbance (unemployment). The following 3 variables were analyzed in the estimation model:

1. Unemployed with work experience
2. Average monetary income
3. Monthly household expenditures

The unemployed variable with work experience is considered, the variable where there are incomes from less than the basic, to the living wage with the following percentages: Less than the basic 15 %, basic unified 50 %,

more than the basic 25 %, living wage 10 %. The remaining two indicators unfold this indicator, standing out; people with work and without work, who have other sources of income, where the largest source of income is from insurance which represents 38%, since this income runs on the part of companies, this indicator exceeds 39% of people who have none of these other sources of income.

As for monthly household expenditure, the values represented are in the direction of consuming wage income especially in food with 24% of income, followed by transport with 23%, similar situation with education with 22%, and also the situation referring to housing rent, which represents 18% of respondents' income, then health and clothing relegated to 7% and 6% respectively. It is inferred that families cannot dedicate a percentage of their income to savings since their income does not reach their wage income.

According to the results obtained, the data related to the indicators that represent existing poverty conditions in Quevedo, Ecuador, take on a spatial character (because they are georeferenced phenomena in a particular region), therefore the regression is carried out through spatial econometric models, with the objective of taking into account the possible existence of processes of spatial dependence and heterogeneity, which affect the quality of the estimates.

The problem of predicting the criminal behavior reached by the society of Quevedo Ecuador, under conditions of poverty, and the use of spatial econometric techniques is based on the localized spatial correlation. This approach considers that the observed results are related to each other, due to non-observable spatially correlated components in order to obtain efficient parameter estimates and make correct inferences.

Spatial econometrics is applied through a weighting matrix that takes into account the proximity between i and j observations. The weights are established on whether or not there is a common boundary between jurisdictions. The weighting matrix was standardized according to unemployed variables with work experience, average monetary income and monthly household expenditures.

On the results obtained, using the matrix of standardized weights, it was possible to obtain the residual spatial dependency value. Analysis where it is verified that the variable that has been robust in the econometric estimates is the density of poverty, based on low monetary income. Data reflected in a spatial error correlated between jurisdictions.

Of the aspects analyzed, through spatial econometrics, the density of poverty based on low monetary income is the variable to be analyzed, which has risk factors that positively affect the criminal behavior of Quevedo, Ecuador.

According to the results obtained when applying spatial econometrics, Neutrosophy is used to interpret the data, which have a qualitative structure and are referred to in linguistic terms. The neutrosophic model, based on ideal distance for the analysis of the risk factors that positively affect the criminal behavior of Quevedo, Ecuador, presents an evaluation framework, through the linguistic terms defined in Table 1, where the following 3 alternatives were evaluated:

- The risks of social exclusions (x1)
- The risks of psychological exclusions (x2)
- The risks of cultural exclusions (x3)

The criteria to be considered for the evaluation of the 3 alternatives referred to above are:

The economic (c1)

- The sociopolitical (c2)
- Psychological or emotional (c3)

Once the evaluation framework has been established, the information is collected, the results of which are shown in Table 2.

	$x1$	$x2$	$x3$
$c1$	MDG	EG	VG
$c2$	G	MDG	B
$c3$	MDG	MDG	G

Table 2: Results of the collection of information

The vector used has the following weights: W = (0.58,0.28,0.20). The opinions of the decision-makers are then aggregated using the aggregation operator that calculates the Single valued neutrosophic weighted averaging (SVNWA)(eq , proposed by [24], the result being shown in Table 3.

	Aggregation	Scoring	Ranking
x1	(0.53, 0.4, 0.56)	1.83	2
x2	(0.43, 0.0, 0.0)	2.53	1
x3	(0.66, 0.52, 0.63)	1.72	3

Table 3: Results for the evaluation

According to the scoring function the alternatives are ordered as follows: x2> x1> x3, which means that:

1. Psychological exclusions constitute the factor of greatest incidence in criminal behavior in Quevedo, Ecuador. A factor that contributes to people's extreme vulnerability.
2. The risk of psychological exclusions that leads to a high multidimensional poverty rate, given the set of deficiencies of households when considering three dimensions (health, education and standard of living), contributes to the fact that citizens have an impact on the criminal process.
3. The risks of cultural exclusion lead citizens to high economic consequences and give rise to characterizations of extreme poverty, low wages and lack of employment that lead them to severe criminal behaviour.

Conclusion

The paper analysis of criminal behaviour in Quevedo, Ecuador, identified the socio-economic factors with the greatest impact on the problems addressed. Spatial econometrics showed that these factors are interrelated. We obtained the risk factors associated with the socioeconomic factors detected in criminal behavior in Quevedo, Ecuador, which were analyzed through a neutrosophic model based on ideal distance, because the data obtained were qualitative and expressed in linguistic terms.

Through the use of the neutrosophic model, based on ideal distance, for the analysis of risk factors that positively affect the criminal behavior of Quevedo, Ecuador, it was possible to combine different data providing a single output. It was found that people who are psychologically excluded are more vulnerable to delinquency.

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Received: January 11, 2019. Accepted: May 9, 2019

Neutrosophic model to determine the degree of comprehension of higher education students in Ecuador

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Abstract. In the process of comprehension, the previous knowledge possessed by the individuals are used to infer the meaning of certain thing, this process is fundamental for the development of the abilities and skills of the students. Neutrosophy and in particular a model based on neutrosophic sets, using results obtained through linguistic terms, are used to determine the degree of comprehension that higher education students should have. Therefore, the objective pursued in this paper is to determine the degree of understanding that higher education students in Ecuador have, in order to favor the teaching-learning process, with the specific goal of finding, from a critical perspective, new teaching goals based on a better understanding of the processes involved in understanding, in order to incorporate them into the educational teaching process.

Keywords: Comprehension, teaching-learning, Neutrosophy, teaching - educational process, abilities, skill

1 Introduction

Understanding is considered a basic competence within existing educational models. It constitutes an approach to the teaching-learning process based on competencies and performances, associated with constructivist theories.

From Quispe Santos' point of view, the capacity to understand accompanies us throughout our existence and represents one of the most significant expressions of human knowledge. There are ideological antecedents that correspond to the process of teaching comprehension.

The process of understanding is not about innovative proposals, but rather it has solid foundations in experts on the learning of recent times. Essentially, comprehension constitutes a critical factor that affects learning, plays a fundamental role with the mental state, and in particular, with the intelligence and capacity that individuals have to learn and retain information, as well as the fact that it continues in constant education and training. This is achieved when we have quality educators, better curricular proposals, and new and efficient pedagogical. [1]

Understanding means being able to go beyond what has been learned, to operate with knowledge in new situations in order to solve problems. According to [2], the process of comprehension implies producing a certain number of activities in order to achieve higher levels of comprehension.

The aforementioned author states that comprehension is necessary to facilitate knowledge. This approach requires a group of activities that help to achieve a flexible performance, and go beyond the information provided.

Activities that teachers propose to students for greater understanding when using the content for learning are those referred by , highlighting the explanation, exemplification, application, justification, comparison and contrast, contextualization and generalization of content. The deficiencies in the retention, comprehension and active use of knowledge in the teaching-learning process are those that are defined by different studies, highlighting those of Gardner, where it exposes the students' comprehension as the center of the mentioned deficiencies, since a true Higher Education according to[3] includes the constant evaluation and reformulation of each process in order to guarantee an efficient comprehension.

Refers [4], that the main deficiencies associated with comprehension are those presented through fragile knowledge in students, denoting that they do not remember, do not understand or do not actively use part of what they have supposedly learned. Also, poor knowledge constitutes a deficiency associated with comprehension, it is shown at the moment when students do not know how to think using what they know. To contribute to improve

these deficiencies, Gardner [5], in his theory of multiple intelligences, proposes guidelines to represent multiple forms of a given knowledge.

The comprehension approach is a characteristic that is translated into human behavior, which has led many researchers of the subject to delve into analyzing the factors that intervene in behavior. With respect to this approach, models have been developed that approximate a classification of the different characteristics implicit in the understanding of higher education students in Ecuador.

In order to measure the students' comprehension, it is required to have information related to the phenomenon of study. The information that is available, on occasions, for such measurement is imprecise, reason why it is necessary the construction of models based on the human reasoning, because of these reasons is that the use of Neutrosophy is proposed in this work. Specifically, neutrosophic logic, which is useful to describe an imprecise logical system, based on neutrosophic subsets by means of linguistic variables.

2 Preliminaries

2.2 Neutrosophy Theory

Neutrosophy [6, 7] is theory developed for dealing with indeterminacy in real world. The truth value in neutrosophic set is as follows [8]:

Let N be a set defined as:

$$N = \{(T, I, F) : T, I, F \subseteq [0, 1]\} \quad (1)$$

Moreover a neutrosophic valuation n is a mapping from the set of propositional formulas that is for each sentence p we have

$$v(p) = (T, I, F) \quad (2)$$

To facilitate the real world applications of neutrosophic set and set-theoretic operators single valued neutrosophic set (SVNS) [9] was developed

A single valued neutrosophic set (SVNS) has been defined as follows [9]:

Definition 1. Let X be a universe of discourse. A single valued neutrosophic set A over X is an object having the form:

$$A = \{\langle x, (x), r(x), vA(x)\rangle : x \in X\} \quad (3)$$

where $u_A(x): X \rightarrow [0,1]$, $r_A(x), : X \rightarrow [0,1]$ and $v_A(x): X \rightarrow [0,1]$ with $0 \leq u_A(x) + r_A(x) + v_A(x) :\leq 3$ for all $x \in X$. The intervals $u_A(x)$, $r_A(x)$ y $v_A(x)$ denote truth- membership degree, indeterminacy-membership degree and falsity membership degree of x to A, respectively.

Single valued neutrosophic numbers (SVN number) is denoted by $A = (a,b,c)$, where $a,b,c \in [0,1]$ and $a+b+c \leq 3$.

2.2 Neutrosophic Inference

Neutrosophic logic is based on linguistic rules dictated by experts [10], in order to treat the indeterminacy in a systematic way, but not entirely quantitative, because the key elements of human thought are not numbers, but concepts that can be represented by neutrosophic sets such as "high", "very high", "very high".[11]

Neutrosophic logic uses granulation, which is defined by Zadeh [12], as the use of words seen as a form of neutrosophic quantification. Neutrosophic logic makes use of the theory of neutrosophic con-joint, in order to give a degree of membership or belonging to its linguistic variables, which allows accepting a partial membership to certain sets, which are generalized with the theory of classical sets [8].

In order to model information, the neutrosophic inference [13]is used, which is the process of mapping input variables to an output space based on a mechanism of neutrosophic logic understood by the If-Then rules, the functions of belonging and the neutrosophic logical operators.

In an inference process a a typical deneutrosophicated value [14] denoted $\mathrm{den}(T_B(y))$ by the centroid or center of gravity method which is given below [15]:

$$\mathrm{den}(T_B(y)) = \frac{\int_a^b T_b(y) y \, dy}{\int_a^b T_b(y) \, dy} \quad (4)$$

Based on the above, the neutrosophic model is established to determine the degree of comprehension of higher education students in Ecuador. The model allows the use of different functions of belonging; in particular, the

trapezoidal function, given that its main advantage lies in the margin of tolerance around the value that is taken as most representative of the linguistic value associated with the neutrosophic set [16], as well as the center of gravity of the neutrosophic set[3] .

3 Proposed Model

The neutrosophic model proposed in this paper is presented in Figure 1. The model consists of four stages: data collection, Neutrosification, Neutrosophic inference rules and De - Neutrosification.

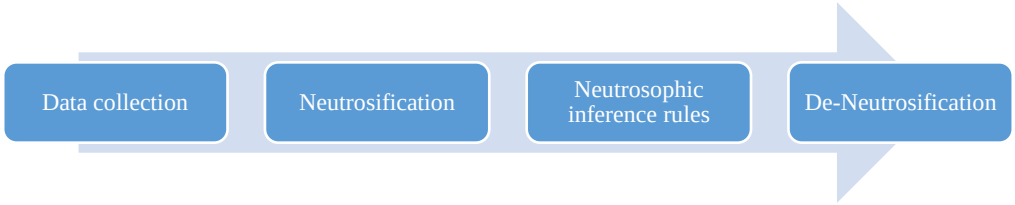

Figure 1: Proposed model. Source: Prepared by the authors.

The phases of the model are described below:

1. Data collection

A sample of 120 students of higher level was used, to them were applied the technique of observation of the activities that they carry out in their performance of pre-professional practices, to evaluate the understanding of the learning they have and their performance as future professionals. The process of classifying the learning was carried out according to the dimensions proposed by the psychologist Ausubel [17], which are:

- The way in which the informative material is presented to the student

- How the student incorporates information into his or her cognitive structure

The dimensions referred to have different types of learning are:

- Receptive learning
- Learning by discovery
- Repetitive or memoiristic learning
- Meaningful learning

According to the types of learning, the results are obtained by applying the technique of observation of the activities they carry out in their performance of pre-professional practices, in order to evaluate their understanding of the learning they have and their performance as a future professional [3].

2. Neutrosification

Neutrosification is performed once the data has been obtained, in order to define the linguistic variables and values, as well as the function of belonging to perform Neutrosification [18]. The linguistic variables identified are the types of learning related to the dimensions proposed by the psychologist Ausubel,[19].

3. Neutrosophic Inference Rules

Neutrosophic inference rules allow establishing a categorization, that is, the possibility of detecting a certain type of behavior pattern, which in this case represents the most significant or representative type of learning of students in accordance with the understanding of learning in higher education in Ecuador. This rule is based on the technique of observation of the activities they carry out in their performance of pre-professional practices.

The proposed neutrosophic model obeys a type of structure that is modeled based on the definition of a set of rules of the form:

$$\text{Si } X1 = A1 \text{ y } X2 = A2 \text{ y } \ldots\ldots \text{ y } Xn = An \text{ then } Z = B. \quad (5)$$

Where both the values of the linguistic variables of the antecedent (X_1, X_2,...Xn) and of the consequent (Z) are neutrosophic sets, in essence, linguistic results with associated semantics.

4. De - Neutrosification

The "De - Neutrosification" carries out the process of adapting the neutrosophic values generated in the inference, in this process the center of Gravity Method (COG) is used (Eq. 2).

With the De - Neutrosification the value y' is determined for the output variable, which has a maximum in its function of belonging B', if there is more than one maximum value in the function of belonging the average of them is taken.

3 Case Study

Based on the model proposed in Figure 1, the results shown in Table 1 are obtained from the data collection phase.

Receptive learning	Learning by discovery	Repetitive or memoiristic learning	Meaningful learning
5	5	0	0
6	7	1	4
8	10	4	5
9	8	5	7
10	7	2	12
11	10	10	12
9	11	16	18
9	15	12	13
9	16	14	12
12	19	12	15
9	2	10	9
7	6	14	10
5	1	13	2
6	2	5	1
5	1	2	0
120	120	120	120

Table 1: Results obtained when applying the technique of observation of the activities they carry out in their performance of pre-professional practices, to evaluate the understanding of learning. Source Own elaboration.

The following linguistic variables were identified in the Neutrosification process:

receptive: REAL

discovery: REAL

memoiristic: REAL

significant: REAL

NEUTROSIFICATION

TERM vh: = (0.85, 0) (0.9, 1) (1, 1)

TERM lo: = (0.4, 0) (0.45, 1) (0.55, 1) (0.55, 0)

TERM me: = (0.5, 0) (0.55, 1) (0.75, 1) (0.8, 0)

TERM hi: = (0.75, 0) (0.8, 1) (0.85, 1) (0.9, 0)

The inference of neutrosophic rules were considered the 4 types of learning and 4 linguistic values (very low, low, medium, high) being obtained:

Rules for very high style (vh)

IF (receptive IS vh AND discovery IS NOT vh AND memoiristic IS NOT vh AND significant IS NOT vh) THEN receptive-learning IS vh

Rules for high style (hi)

IF (receptive IS hi AND discovery IS NOT hi AND memoiristic IS NOT hi AND significant IS NOT hi AND discovery IS NOT vh AND memoiristic IS NOT vh AND significant IS NOT vh) THEN receptive-learning IS hi

Rules for the medium style (me)

IF (receptive IS NOT me AND discovery IS NOT me AND memoiristic IS NOT me AND significant IS NOT me AND discovery IS NOT vh AND memoiristic IS NOT vh AND significant IS NOT vh AND discovery IS NOT hi AND memoiristic IS NOT hi AND significant IS NOT hi) THEN receptive-learning IS me

Rules for low style (lo)

IF (receptive IS lo AND discovery IS NOT me AND memoiristic IS NOT me AND significant IS NOT me AND discovery IS NOT vh AND memoiristic IS NOT vh AND significant IS NOT vh AND discovery IS NOT NOT hi AND memoiristic IS NOT hi AND significant IS NOT hi AND discovery IS NOT lo AND memoiristic IS NOT lo AND significant IS NOT lo) THEN receptive-learning IS lo

Rules for very high styles (vh)
IF (receptive IS vh AND discovery IS vh AND memoiristic IS NOT vh AND significant IS NOT vh) THEN learning_e_Discovery IS vh;

Rules for very high styles (vh)
IF (receptive IS ma AND discovery IS ma AND memoiristic IS ma AND significant IS NOT ma) THEN receptive-discovery-memoristic-learning IS vh;

Rules for very high styles (vh)
IF (receptive IS vh AND discovery IS vh AND memoristic IS vh AND significant IS vh) THEN recepetive-discovery-memoristic-significant-learning IS vh;
The result of the De - Neutrosification are shown below:

Output Variables

receptive_learning: REAL;

discovery_learning: REAL;

memorial_learning: REAL;

cognitive_learning: REAL;

recptive_discovery_learning: REAL;

memorial_receptive_learning: REAL;

significant_receptive_learning: REAL;

Receptive_ memoristic_learning: REAL;

Significant _discovery_learning: REAL;

Significant_memoristic_learning: REAL;

receptive _memoristic_discovery_learning: REAL;

receptive_ significant_discovery: REAL;

Significant_memoristic_learning: REAL;

receptive_ significant_memoristic_discovery_learning: REAL;

receptive_ significant_memoristic_discovery_learning: REAL;

Based on the inference made and the definition of the output variables, the De - Neutrosification shown below corresponds to the case of receptive learning.
De-Neutrosification - receptive_learning

TERM vg := (0.3, 1) (0.4, 1) (0.45, 0);

TERM lo := (0.4, 0) (0.45, 1) (0.5, 1) (0.55, 0);

TERM me := (0.5, 0) (0.55, 1) (0.75, 1) (0.8, 0);

TERM hi := (0.75, 0) (0.8, 1) (0.85, 1) (0.9, 0);

TERM vh := (0.85, 0) (0.9, 1) (1, 1);

METHOD : COG;

DEFAULT := 0.3;

RANGE := (0.3 .. 1);

For "De - Neutrosification" the center of gravity is used, which implies that the value to be obtained for the type of receptive learning is located in the center of the range of belonging. Table 2 shows a summary of the types of learning predominantly after applying the neutrosophic model, obtained in the students, according to the technique of observation of the activities they carry out in their performance of pre-professional practices.

Number of Students	Type of apprenticeships with the observation technique	Types of learning with the proposed model	Degree of belonging to the type of learning
22	Discovery	Discovery	High
19	Significant	Significant	High
17	Discovery	Memoristic Discovery	Very High
10	Discovery	Memoristic Significant	Medium
9	Memoristic	Memoristic	High
7	Receptive	Significant Discovery	Medium
4	Significant	Memoristic Significant	Very High
4	Discovery	Memoristic Significant	High
3	Receptive	Receptive	Medium
3	Receptive	Receptive Discovery	Medium
2	Memoristic	Receptive	Medium
2	Memoristic Receptive	Memoristic	Very High
2	Significant Discovery	Memoristic Discovery	Very High
2	Memoristic Discovery	Memoristic Discovery	High
2	Memoristic	Memoristic Discovery	High
2	Memoristic Discovery	Memoristic Discovery	High
2	Significant	Significant	Medium
2	Memoristic	Receptive Discovery	Medium
3	Memoristic	Memoristic Significant	Medium
3	Memoristic Significant	Memoristic Significant	Medium

Table 2: Comparative summary of the types of learning. Source Prepared by the authors

Conclusion

In the present work, we made an identification of the understanding of learning as a psychological element that affects the teaching-learning process of higher level teachers. Neutrosophy was used and, in particular, a neutrosophic model was created to determine the degree of understanding of learning among higher education students in Ecuador.

With the neutrosophic model, a classification of the neutrosophic inference was carried out through the model, in addition to classifying the types of learning for the comprehension of learning in students at the higher level, it allows determining the degree of belonging of the types of learning or the predominant types of learning.

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Received: January 12, 2019. Accepted: May 11, 2019

Pestel based on neutrosophic cognitive maps to characterize the factors that influence the consolidation of the neo constitutionalism in Ecuador

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Abstract. This paper analyzes the main contradictions existing in Ecuador for the consolidation of neo-constitutionalism, which is considered as; the new legal theory, which seeks to transform the rule of law into the constitutional rule of law, proposing for it; greater state intervention and creation of egalitarian democratic spaces and respect for human rights among state agencies and institutions. For this reason, the objective of this work is to characterize the factors that influence the consolidation of neo-constitutionalism in Ecuador, as an ideological and methodological theory of law. In order to characterize the factors that influence the consolidation of neo-constitutionalism in Ecuador, the PESTEL methodology based on neutrosophic cognitive maps is used, which constitutes a tool for the analysis of the environment that analyzes political, economic, social, technological, ecological and legal factors. A documentary analysis is carried out that deals with the pretentious materials of the institutionalization of neo-constitutionalism in Ecuador, from its contextualization.

Keywords: Neo constitutionalism, Rule of Law, Constitutional Rule of Law, State intervention, egalitarian democratic spaces, PESTEL, neutrosophic cognitive map.

1 Introduction

Neo-constitutionalism alludes to a new vision of the rule of law that starts from postmodern constitutionalism, its main characteristic is the primacy of the constitution over other legal norms and that constitute a distinction between rules as legal norms and principles as institutional norms. From the historical point of view, neo-constitutionalism has its starting point in the responses to the fascist legal-political regimes of 20th century Europe, especially Germany, Italy and Spain. Countries that were characterized by having three traditional models that have to their credit serious violations of human rights and the construction of a legal state of authoritarian rights[1] .

For[2] the fundamental feature that this constitutional tendency shares with the new Latin American constitutionalism or transformative constitutionalism is the strengthening of judges and in particular of constitutional judges and courts. It states that neo-constitutionalism arises in connection with the development of the process of constitutionalization of law and its intention is to overcome and replace juridical positivism.

According to the affirmation of the referred author, it is to emphasize that, for the neo-constitutionalism, the constitutionalization of the right once reached by a country, has as objective, that of dethroning to the classic positivism, as theory of the right. However, there are other aspects that constitute characteristic and important characteristics of the new Latin American constitutionalism, highlighting the strengthening of political participation, concern for equality and diversity, social and collective rights, constitutional regulation of the economy, openness to international law and secularism, as it refers[3].

In Ecuador, this system is reflected in the drafting of the 2008 Constitution, a state that guarantees rights and whose demands are made individually or collectively. In addition, the following categories of fundamental rights are established: good living, rights of individuals and priority groups, rights of communities, peoples and nationalities, rights of participation, rights of freedom, rights of nature, and rights of protection.

Refers [6], conducts a critical analysis of the system, referring to the categories of rights in the 2008 Constitution and points out that civil rights, considered as rights of freedom and social rights, are called rights of good living; political rights and are currently known as rights of participation. Five characteristics define the consolidation of neo-constitutionalism; in Ecuador, it defines[4].

a) Predominance of principles over rules

(b) Frequent use of the weighting technique to the detriment of subsumption

(c) Relevant and active presence of judges over legislators

(d) Recognition of evaluative pluralism as opposed to ideological homogeneity

(e) Invasive constitutionalism that permeates all areas of law

For Ecuador, the aforementioned characteristics emphasize the inclusion in the constitutional texts of principles such as the plurinational state, community democracy, the rights of nature and good living, which can be summarized in a broad and radical conception of democracy, understood beyond elections, in its political, cultural and economic dimensions as referred to [8]. With respect to the mediated conditions, the new Latin American constitutionalism, and particularly in Ecuador, has its own roots in the juridical currents of radical democracy, which developed in the continent in different historical periods.

Based on the above-mentioned characteristics, the PESTEL methodology is used, which, by its acronym, describes the Political, Economic, Social, Technological, Ecological and Legal factors, to analyze the factors that influence the consolidation of neo-constitutionalism in Ecuador. The PESTEL methodology offers a unilateral and temporary approach to the multipresentiality of the conditioning factors in a given system.[5]

The analysis through the PESTEL model, according to [9], without claiming the invention of the acronym "PESTEL". In this article, the PESTEL model integrates the factors shown in Figure 1 [5].

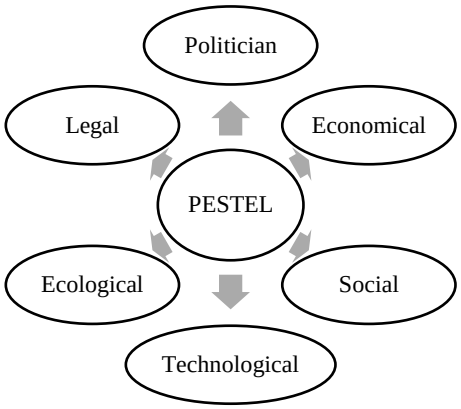

Figure 1: Factors that integrate the PESTEL analysis to characterize the most frequent contradictions and limitations on the consolidation of neo-constitutionalism in Ecuador. Source: Prepared by the authors.

In order to identify the variables corresponding to the most frequent contradictions and limitations on neo-constitutionalism in Ecuador, the environmental factors are grouped into the dimensions specified in Figure 1 using the PESTEL model, as referred to[6]. Once the main incident factors in the consolidation of neo-constitutionalism in Ecuador have been identified, PESTEL is analyzed with neutrosophic cognitive maps (NCM), in order to facilitate a greater interpretability of the results obtained.[7, 8]

NCMs are tools based on Neutrosophy, which was proposed for the treatment of neutrality. It has formed the basis for a series of mathematical theories that generalize classical and diffuse theories such as neutrosophic sets and neutrosophic logic.

The original definition of truth value in neutrosophic logic is shown as referring[6] as $N = \{(T,I,F): T,I,F \subseteq [0,1]\}$ n, which represents a neutrosophic valuation, considered as a mapping of a group of propositional formulas to N, and for each sentence p to obtain the result through equation 1.

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

Neutrosophic logic is a generalization of fuzzy logic, based on the concept of Neutrosophy according to [14, 15], where a neutrosophic matrix is a matrix where the elements $a = (a_{ij})$ are replaced by elements at $\langle R \cup I \rangle$, where $\langle R \cup I \rangle$ is an entire neutrosophic ring [9]. On the other hand, a neutrosophic graph is a graph in which at least one arc is a neutrosophic arc [10].

In a neutrosophic adjacency matrix[11, 12] the arcs that are equal to 0, mean that they do not have connection between nodes, if they are equal to 1, it means that they have connection between nodes, and if they are equal to I, it means that the connection is indeterminate (unknown if it is or not). Such notions are not used in diffuse theory.

On the other hand, if indeterminacy is introduced into a cognitive map as referred to [13], then that cognitive map is called a neutrosophic cognitive map, which is especially useful in the representation of causal knowledge .

3 Materials and Methods

In the present study, an analysis of PESTEL with neutrosophic cognitive maps is carried out to characterize the factors that influence the consolidation of neo-constitutionalism in Ecuador, from a descriptive methodology with quantitative method. The result obtained when using the descriptive methodology is feasible to define the characteristics of the factors that intervene in the PESTEL model related to the consolidation of neo-constitutionalism in Ecuador.

In accordance with the objective proposed in the present work, a framework is developed that facilitates the analysis of PESTEL based on neutrosophic cognitive maps [9]. The proposed framework is shown in Figure 2.

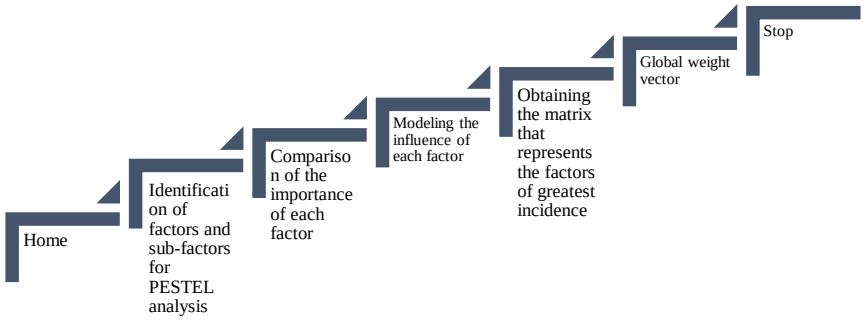

Figure 2: Framework for obtaining the characteristics to analyze in each factor of the PESTEL model based on neutrosophic cognitive maps. Source: Own elaboration.

The framework proposed in Figure 2 guides the process of obtaining the characteristics of each factor analyzed in the consolidation of neo-constitutionalism in Ecuador with the PESTEL model. The integrated structure of the factors that correspond to perform a PESTEL analysis and their characteristics are modeled through the use of a neutrosophic cognitive map, which contributes to obtaining a quantitative analysis of the characteristics that correspond to the analysis factors[10]. The following is a summary of the characteristics of each factor analyzed in the consolidation of neo-constitutionalism in Ecuador with the PESTEL model.

Neutrosophic cognitive maps are a generalization of fuzzy cognitive maps[14] . Fuzzy cognitive maps are introduced by Axelrod [15] where nodes represent concepts or variables in a given study area and arcs indicate positive or negative influences, which are considered causal relationships. They have been applied in several areas, especially in decision support and in the analysis of complex systems as referred to [16].

3 Results

The factors and characteristics of the PESTEL model obtained for the characterization of neo-constitutionalism in Ecuador are shown in Figure 3. The characteristics obtained and related to the factors of the PESTEL model are based on the framework proposed in Figure 2.

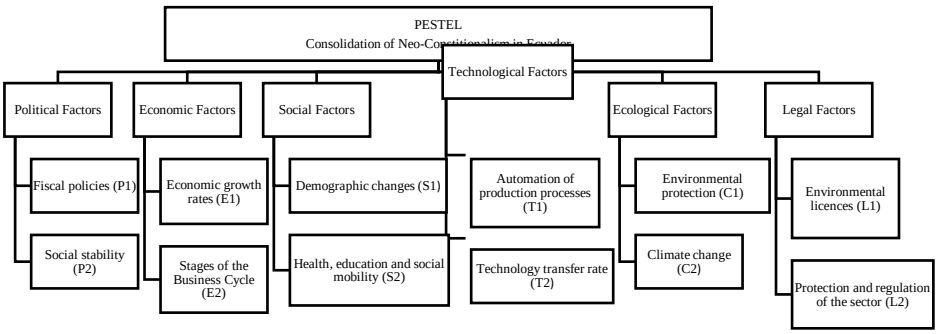

Figure 3: PESTEL hierarchical model for the characterization of neo-constitutionalism in Ecuador. Source: Prepared by the authors

Once the characteristics corresponding to the factors of the PESTEL model have been obtained, they are analyzed, through the characteristics of the PESTEL model, as a strategic analysis technique to define the context of a given area through the analysis of a series of external factors, as referred by [17]. The PESTEL analysis incorporates Ecological and Legal factors into the PEST analysis, for which reason a PEST analysis was previously carried out in this research to measure the impact of macro-environmental factors in terms of the characteristics present in the consolidation of neo-constitutionalism in Ecuador. The factors analyzed with the PEST technique were:

- Political factors; these factors are those related to the impact of any political or legislative change that may affect the consolidation of neo-constitutionalism in Ecuador.
- Economic factors; these factors are those referred to the economic affectations that institutions have, in the national, international or global order. The purchasing power related to the period of boom, recession, stagnation or recovery that the economy of the region under study is highlighted.
- Social factors; these factors focus on the forces that act within society and affect the attitudes, interests and opinions of those who influence decision-making.
- Technological factors; related to the use of technology, since it constitutes the driving force that contributes to an improvement in quality and entry barriers are reduced.

Once the macro-environmental factors have been established through the PEST technique, the external factors that influence the consolidation of neo-constitutionalism in Ecuador are defined, using the PESTEL technique. Factors obtained for the purpose of defining the context in which neo-constitutionalism is framed in Ecuador and measuring its consolidation. The factors that are analyzed through the PESTEL technique are, according to them:

1. Ecological factors
2. Legal Factors

The ecological factors analyzed in the consolidation of neo-constitutionalism in Ecuador correspond to the characteristics related to environmental protection and climate change. On the other hand, and with regard to legal factors, the characteristics related to environmental licenses and the protection and regulation of the sectors with the greatest impact on the consolidation of neo-constitutionalism are analyzed.

The results obtained with the analysis of PEST and PESTEL, where the characteristics that represent the factors under study are obtained, are presented in linguistic terms, so that in order to obtain a greater interpretability of them it is necessary to treat them in order to be able to quantify them. For this reason, in the present study, neutrosophic cognitive maps are used as a tool for the modeling of the characteristics related to the factors that influence the consolidation of neo-constitutionalism in Ecuador.

The neutrosophic cognitive map (NCM) is composed of a neutrosophic graph, in which at least one arc is a neutrosophic arc and this represents the present indetermination [12]. It is useful in the re-presentation of causal knowledge, as it allows the representation and analysis of indetermination [11].

Static analysis in a neutrosophic cognitive map [18]focuses on the selection of the most important concepts, characteristics or factors in the modeled system. The static analysis, referred to, is performed from the adjacency matrix, and is considered the absolute value of the weights.

A static analysis in MCN gives as initial result, a neutrosophic number of the form (a+bI, where I = indetermination). For its interpretation, a de-neutrosification process is required, as proposed by Salmerón and Smarandache.

In the De-Neutrosification process indetermination ($I \in [0,1]$) is replaced by its maximum and minimum values. Essentially, to perform a static analysis on a neutrosophic cognitive map the steps shown in Figure 4 must be followed.

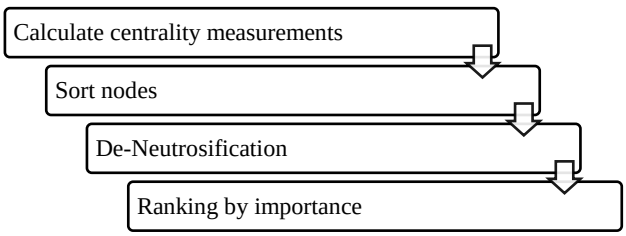

Figure 4: Steps to follow for static analysis in a neutrosophic cognitive map. Source: [5]

The measures described below are used in the proposed model; they are based on the absolute values of the adjacency matrix:

Outdegree od(vi) is the sum of the rows in the neutrosophic adjacency matrix. It reflects the strength of the outgoing relations (cij) of the variable.

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

Indegree id(vi) is the sum of the columns, it reflects the strength of the outgoing relations (cij) of the variable.

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

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

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

For the evaluation of PESTEL factors with a neutrosophic cognitive map, the factors obtained with the PESTEL technique and the characteristics related to each factor that were represented hierarchically in Figure 3 are taken into account. In the present study, the MCN is developed by capturing knowledge. The generated neutrosophic adjacency matrix is shown in Table 1.

Nodes	P1	P2	E1	E2	S1	S2	T1	T2	C1	C2	L1	L2
P1	0	0	0	-0.3	0	0	0	0	0	0	0	0
P2	0	0	0	0	0	0	0.25	0	0	0	0	0
E1	0	0	0	0	0	0	0	0	0	0	0	0
E2	0	0	0	0	0	0	0	0.3	0	0	0	0
S1	0.4	I	0	0	0	0	0	0	0	0	0	0
S2	0	0	0	0	0	0	0	0	0	0	0	0
T1	0	0	0	0	0	0	0	0	0	0	0	0
T2	0	0	0	0.35	0	0	0	0	0	0	0	0
C1	0	0	0	0	0	0	0	0	0.25	0	0	0
C2	0	0	0	0	0	0	0	0	0	0	0	0
L1	0	0	0	0	0	0	0	0	0	0.30	0	0
L2	0	0	0	0	0	0	0	0	0	0	0	0.20

Table 1: Neutrosophic adjacency matrix. Source: Own elaboration.

The centrality measurements are calculated through the Outdegree and Indegree measurements, the results of which are shown in Table 2.

Nodes	Id	Od
P1	0.4	0.3
P2	I	0.25
E1	0	0.2
E2	1.05	0.3
S1	I	0.7+1
S2	0	I
T1	0.55	0.2
T2	0.3	0.35
C1	0.25	0
C2	0.30	0
L1	0	0.30
L2	0	0.20

Table 2: Measures of centrality, Outdegree, Indegree. Source: Prepared by the authors.

Once the measures of centrality have been calculated, the nodes of the neutrosophic cognitive map are classified, a classification shown in Table 3.

Nodes	Transmitte Node	Receiving Node	Ordinary
P1			X
P2			X
E1			X
E2	X		
S1			X
S2	X		

T1	X
T2	X
C1	X
C2	X
L1	X
L2	X

Table 3: Classification of the nodes. Source: Own elaboration.

According to the results shown in Table 3, the subsequent nodes are classified. In this case, E2 and S2 are the receiving nodes. The rest of the nodes are ordinary. The total degree td(vi) is calculated through equation 4, the results for our case study are shown in Table 4.

Nodes	td
P1	0.7
P2	0.25+I
E1	0.2
E2	1.35
S1	0.7+2I
S2	I
T1	0.75
T2	0.65
C1	0.25
C2	0.30
L1	0.30
L2	0.20

Table 4: Total centrality. Source: Prepared by the authors.

The next step is the process of De-Neutrosification as refer [10], where $I \in [0,1]$, is replaced by maximum and minimum values. In Table 5, the values of the intervals are shown

Nodes	td
P1	0.7
P2	[0.25, 1.25]
E1	0.2
E2	1.35
S1	[0.7, 2.7]
S2	[0, 1]
T1	0.75
T2	0.65
C1	1.25
C2	1.30
L1	1.30
L2	1.20

Table 5: Neutrosification of the total centrality values. Source Own elaboration.

Finally, we work with the mean of the extreme values, which is calculated through equation 5, which is useful to obtain a single value according to [11]. Value that contributes to the identification of the characteristics according to the factors obtained with the PESTEL model, for our case study.

$$A > B \leftrightarrow {}^{(a_1 + a_2)}/_2 > {}^{(b_1 + b_2)}/_2 \qquad (5)$$

Then;

$$\lambda([a_1 + a_2]) = {}^{(a_1 + a_2)}/_{2} \quad (6)$$

Based on equation 5, we obtain the median of the extreme values to analyze the characteristics to attend according to the factors obtained through the PESTEL technique in this study. The results are shown in table 6.

Nodes	td
P1	0.7
P2	0.75
E1	0.2
E2	1.35
S1	1.7
S2	0.5
T1	0.75
T2	0.65
C1	1.25
C2	1.30
L1	1.30
L2	1.20

Table 6: Median of extreme values. Source Own elaboration.

From these numerical values the following order is obtained:

$$S_1 > E_2 > C2 > L1 > C1 > L2 > P_2 > T_1 > P_1 > T_2 > S_2 > E_1$$

The factors to consider for the consolidation of neo-constitutionalism in Ecuador are technological, political and economic.

Conclusion

This study characterizes the consolidation of neo-constitutionalism in Ecuador. The PESTEL technique is used, which contributed to the analysis of the environment and made it possible to identify the key factors that have a significant impact on neo-constitutionalism in Ecuador. The most influential characteristics of the consolidation of neo-constitutionalism in Ecuador are described for each identified factor.

The characteristics were modeled through the use of neutrosophic cognitive maps, with the interdependencies between the characteristics and the factors identified with the PESTEL technique, where from them a quantitative analysis was made, based on the static analysis provided by the use of neutrosophic cognitive maps.

It is demonstrated through the use of neutrosophic cognitive maps that for the consolidation of neo-constitutionalism in Ecuador, technological, political and economic factors must be taken into account.

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Received: January 24, 2019. Accepted: May 10, 2019

Softcomputing in neutrosophic linguistic modeling for the treatment of uncertainty in information retrieval

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Abstract. Softcomputing is an extension of different concepts and techniques that try to overcome the difficulties presented by real problems that are imprecise, uncertain and difficult to categorize. The use of Softcomputing contributes to clarify that this term is not in itself a precise definition, but is a mixture of techniques, tools and methods that converge among themselves and each process has a specific objective. Within the group of Softcomputing techniques that are frequently used in linguistic modeling, for the treatment of uncertainty and the recovery of information, there is Neurocomputing, Probabilistic Reasoning, Fuzzy Logic and now neutrosophic Logic. In the present work, the combination of Softcomputing and neutrosophic logic is presented, for the neutrosophic linguistic modeling, in the treatment of uncertainty and information recovery, by means of a diffuse ordinal linguistic approximation. Modeling is performed by the linguistic information aggregation operator LOWA, which performs flexible modeling in the treatment of uncertainty and the evaluation of the proposed linguistic information retrieval. For this reason, the objective of this work is to deal with uncertainty in the process of recovering information.

Keywords: Softcomputing, neutrosophic linguistic modeling, uncertainty treatment, information retrieval.

1 Introduction

The interpretation of data, texts and contexts has become a great challenge for the achievement of human and professional development, emerging various informatic tools and philosophical theories that try to transform this reality.

Uncertainty and problem solving are a major issue in the effectiveness of the information management process. Incomplete information needs to be treated in order to reduce bias in all information management processes; therefore, it needs to be treated in order to obtain accurate results in all processes where incomplete and inaccurate information is present [1].

The treatment of uncertainty has become a process of different dimensions, a process that was not carried out until the terms related to the Theory of Probability were conceived. By recognizing from the Theory of Probability, the dimensions defined by [2] and [1], it was that uncertainty began to be dealt with.

According to the diversity that uncertainty presents, different types of uncertainty were established, where from that moment on, its classification began according to Bonnisone and Tong [3]. This uncertainty classification focused on knowledge imperfection, imprecision and incomplete information.

The imprecision and incomplete information, has been used frequently in different branches of science, specifically it has been used to indicate the absence of a value. Essentially imprecision indicates the existence of a value that cannot be measured in its entirety, and uncertainty reveals the fact of a subjective formulation about the veracity of a fact which is not known with certainty.

The need to consider uncertainty in the process of solving problems, bearing in mind that it may be present in the data of a given problem, as in the knowledge used to solve different types of problems, was that the development of various methods of solving uncertainty began.

One of the techniques that has become an effective way to deal with uncertainty, especially when represented

by inconsistency in the data is Neutrosophy. Neutrosophy is a new branch of philosophy [4] that studies the origin, nature and scope of neutrality, as well as its interactions with different ideational spectra.

Neutrosophy has formed the basis for a set of mathematical theories, which generalize the use of neutrosophic logic [4], neutrosophic sets, neutrosophic probability, neutrosophic statistics and multiple practical applications. It constitutes one of the most far-reaching applications at present, to deal with uncertainty and in particular neutrosophic logic [5].

Neutrosophic logic is a non-probabilistic approximate reasoning method [6], which is defined as an extension of fuzzy logic and facilitates the modeling of qualitative information in an approximate manner. Its success is mainly due to the possibility of solving complex and poorly defined problems which, by means of traditional methods, are difficult to solve; among the problems to be solved is the treatment of uncertainty and the retrieval of information.

Information retrieval is dedicated to the storage and retrieval of documents that are not quantitative in nature, i.e. documents with vague and imprecise information. Therefore, in view of this problem, it is recommended to make use of Softcomputing techniques, tools, tools and methods [7].

It is in this context of information retrieval that the development of Softcomputing begins. Softcomputing aims to take advantage of the knowledge of a problem that leads to imprecision and uncertainty, to achieve greater profit, strength and solution.

The main disciplines that converge with Softcomputing are Neurocomputation and Probabilistic Ratio, Fuzzy Logic and now Neutrosophic Logic. Neutrosophic Logic according to [4] is a logic in which each proposition is T% true, I% indeterminate, and F% false.

Based on the above, in the present work, the use of neutrosophic logic is proposed, for the linguistic modeling in the treatment of uncertainty for the recovery of qualitative information. Linguistic modeling has frequently been used in problems where phenomena related to human perceptions and relationships (design, taste, fun, etc.) are evaluated.

2 Preliminaries

2.1 Neutrosophic Linguistic Modeling

In human perceptions and relationships, words from natural language (beautiful, ugly, sweet, salty, sympathetic, many, few, others.) are used instead of numerical values to emit refer valuations. For this reason the use of neutrosophic linguistic modeling is proposed, which has as its theoretical basis the theory of neutrosophic sets and the theory of diffuse sets, techniques that have proved effective in evaluating aspects of qualitative nature [8].

Linguistic variables are used to represent the qualitative aspects whose domain of expression are sets of words or linguistic terms according to [9]. A linguistic variable according to [10]and Herrera and Herrera-Viedma, is characterized by a syntactic value or label and by a semantic value or meaning.

The label is a word or phrase belonging to a set of linguistic terms and the meaning of that label is given by a diffuse subset in a universe of discourse. Since words are less precise than numbers, the concept of linguistic variable is a good proposal to characterize those phenomena that are not suitable to be evaluated through numerical values.

The methodology to be used in neutrosophic linguistic modeling for the treatment of uncertainty in information retrieval follows a diffuse ordinal linguistic approach, an approach that constitutes a technique designed to model the qualitative aspects of a given problem. In a diffuse ordinal linguistic approach, the set of finite labels $S = \{S_i, i \in H = 0, K, T\}$ is assumed, totally ordered in the normal sense and with an odd cardinal (7 or 9 labels) [11].

The central label represents an approximate value of 0.5 and the rest is located symmetrically around it. The semantics of the labels are defined based on the ordered structure of the set of labels when considering the pair par (s_i, S_{T-i}) which means; which is also informative.

Each label has associated a neutrosophic number in the interval [0,1], this neutrosophic number is defined by a trapezoidal membership function represented by a 4- tuple $a_i, b_i, \alpha_i\, \beta_i$. The first two parameters indicate the interval in which the value of belonging is 1; the third and fourth indicate the amplitude to the left and to the right of the distribution), with the following properties:

1. Order: $S_i \geq S_j$ if $i \geq j$
2. Negation: $Neg(S_i) = S_j$, with $j = T - i$
3. Maximum: $MAX\ (S_i, S_j) = S_i$ if $S_i \geq S_j$
4. Minimum: $MIN\ (S_i, S_j) = S_i$ if $S_j \leq S_j$

2.2 LOWA operator

For the aggregation of linguistic values the operator LOWA is used, which is an ordinate-do operator based

on symbolic computation [11]. It operates on labels, and considers only the order of them and not their associated semantics. The LOWA operator is defined as:

Let $A = \{a_1, \ldots, a_m\}$, the set of labels to add, then the LOWA operator, Φ is defined as $\Phi(a_1, \ldots, a_m) = W \cdot B^T = C^M\{w_k, b_k, k = 1, \ldots, m\} = w_1 \Theta b_1 \oplus (1 - w_1) \Theta C_m - 1\{\beta_h, bh, h = 2, \ldots, m\}$.
(1)

Where; $W = [w_1, \ldots, w_m]$ is a vector of weights, such that, $w_i \in [0,1]$ y $\sum_i w_i = 1$. $\beta_h = w_h/(\sum_2^m w_k)$, $h = 2, \ldots, m$, y $B = \{b_1, \ldots, b_m\}$ is an ordered vector associated with A, such that, $B = \sigma(A) = \{a_{\sigma(1)}, \ldots, a_{\sigma(m)}\}$, where $a\sigma(j) \leq a\sigma(i) \forall i \leq j$, σ is a permutation about A. C_m is the convex combination operator of m labels and if m=2, then $C2\{wi, bi, i = 1, 2\} = w1 \Theta \text{sj} \oplus (1 - \text{w1}) \Theta si = sk$, such that $k = min\{T, i + round(w1 \cdot (j - i))\} sj, si \in S, (j \geq i)$, Where; round is the rounding operator, y $b1 = sj$, $b2 = si. Si\ wj = 1\ y\ wi = 0$ with $i \neq j \forall i$, that $Cm\{wi, bi, i = 1, \ldots, m\} = bj$.

The LOWA operator is an or-and operator [12], operating between the MIN and MAX operators. In the neutrosophic linguistic modeling proposed in this paper, this operator is used to evaluate Boolean queries and to classify OWA operators according to how they operate between the and and the or, as proposed by Yager [15], who defined a measure of orness, associated with vector W, as shown in equation 1.

$$orness(W) = \frac{1}{m-1}\sum_{k=1}^{m}(m-k)w_k \qquad (2)$$

Set to a W, the closer the OWA operator's behavior is to or closer will be its orness measure to 1; the closer it is to an and, the closer it will be to 0. An OWA operator with a lot of non-zero weights in the first positions, behaves like an or (orness≥ 0.5), however the one presented in the last positions behaves like an and [13, 14].

3. Neutrosophic linguistic modeling framework

Based on the above, Figure 1 shows the components for neutrosophic linguistic modeling framework useful for the treatment of uncertainty in information retrieval.

Figure 1: Components for linguistic modeling in the treatment of uncertainty and information retrieval. Source: Own preparation.

- The Database for the neutrosophic linguistic modeling in the treatment of the uncertainty and the recovery of the information is necessary to store the documents and the representation of their informative contents whose components are the index terms and their weights. These weights indicate the concepts induced by the terms regarding the index of the documents.
- Consultations make it easier for users to specify their information needs by formulating queries.
- Evaluations are performed to evaluate documents for each query using an equality function, where a Recovery status value is assigned to each document.

According to the components described above, it is possible to carry out neutrosophic linguistic modeling to deal with uncertainty and recover the information. This modeling supports weighted linguistic Boolean queries, which solves the inconvenience of AND and OR operators, inconveniences that are given because they operate very restrictively and very inclusively, respectively.

76 For the proposed neutrosophic linguistic modeling, in the first place, a diffuse ordinal linguistic approximation is defined as in [15]. The terms of the queries are weighted by linguistic labels interpreted as significant limits constituting linguistic weights.

Linguistic weights are interpreted as limits to be satisfied in the equalization between documents and consultations. The Boolean operators AND and OR are modeled using the linguistic information aggregation operator LOWA [16], which facilitates the flexibility of the consultation evaluation process. Retrieved documents are classified into notability classes, identified by language tags.

3 Case Study

According to the components defined in Figure 1, the Database for neutrosophic linguistic modeling in the treatment of uncertainty and information retrieval stores the documents $D=\{d_1,....d_m\}$ and their respective representations $R=\{R_1,.....,Rd_m\}$. The documents are represented by index terms $T=\{t_1,..., t_n\}$. Each term has an associated weight describes the content of the documents and is represented through the numerical indexation

function that assigns to each document dj and to each index term ti a numerical weight between 0 and 1, this function is shown through the expression 2.

$$F : DxT \rightarrow [0,1] \quad (2)$$

Where;

$F(dj, ti)$ is a weight that represents the degree to which ti in dj is significant.
$F(dj, ti) = 0$ implies that the document dj, is not represented by you.
$F(dj, ti) = 1$ implies that the document is perfectly represented by you
$F(dj, \dots, ti) \in (0,1)$ represents the different intermediate significant degrees.

The Database in the present work contains seven documents D={d1,...,d7}. The documents are indexed by the indexation function F which assigns the following weights to each term in the documents:

$$Rd1 = 0.7/t5 + 0.4/t6 + 1/t7;\ Rd2 = 1/t4 + 0.6/t5 + 0.8/t6 + 0.9/t7; Rd3 = 0.5/t2 + 1/t3 + 0.8/t4; Rd4 = 0.9/t4 + 0.6/t6 + 1/t7; Rd5 = 0.7/t3 + 1/t4 + 0.4/t5 + 0.8/t9 + 0.6/t10;\ Rd6 = 1/t5 + 0.99/t6 + 0.8/t7;\ Rd7 = 0.8/t5 + 0.02/t6 + 0.8/t7 + 0.9/t8$$

The queries, as component 2, defined in Figure 1, are performed from the linguistic labels stored in the Database. Each query is expressed as a combination of weighted index terms, connected by the Boolean operators $AND\ (\wedge), OR\ (\vee), y\ NOT\ (\neg)$, and weighted by language tags. The linguistic variable "Relevance" is then used to model the linguistic weights, defined by the neutrosophic linguistic approach. For this purpose, a set of ordered labels is considered that are denoted as S to express the linguistic weights.[17] The linguistic variable "Relevance" is used to model linguistic weights, defined by the neutrosophic linguistic approach.

The query itself is considered as a Boolean expression whose components are 2-tuples $< ti, ci >$belonging to the set, $TxS;\ ti \in T$,, where ci is a value of the linguistic variable "Relevance", associated to a limit semantics [18].

The Q set of reliable queries is defined by the following syntax rules:

1. $\forall\ q =< ti, ci > \in TxS \rightarrow q \in Q$
2. $\forall\ q, p \in Q \rightarrow q \wedge p \in Q$
3. $\forall\ q, p \in Q \rightarrow q \vee p \in Q$
4. $\forall\ q \in Q \rightarrow \neg(q) \in Q$
5. All credible queries q ∈ Q are only those obtained by applying the above rules.

Therefore, from the linguistic variables stored in the Database, the query shown in expression 3 is obtained.

$$q = ((t5, VH) \wedge (t6, L)) \vee (t7, H) \quad (3)$$

Through the consultation produced, the representation of the documents is obtained expressed in linguistic form.

$$Label: Rd1 = H/t5 + M/t6 + T/t7;\ Rd2 = T/t4 + M/t5 + H/t6 + VH/t7;\ Rd3 = M/t2 + T/t3 + H/t4;\ Rd4 = VH/t4 + VL/t6 + T/t7;\ Rd5 = H/t3 + T/t4 + M/t5 + H/t9 + M/t10;\ Rd6 = T/t5 + EH/t6 + H/t7;\ Rd7 = H/t5 + EL/t6 + H/t7 + VH/t8$$

Once the query is obtained, component 3 is executed, relative to the evaluation, for this purpose the sensitivity parameter K=2 is assumed, which means the distance between the linguistic values. Therefore, the evaluations are carried out according to the symmetric limit semantics expressed by g^1, which is nothing more than an equalization function different from the classical functions associated with limit semantics, which are increasing monotonous.

In this case the semantics is symmetrical with respect to the central limit values ($S_{T/2}$) which means that g^1 is increasing in $Label(F)$ for limit values greater than ($S_{T/2}$) and decreasing in $Label(F)$ for limit values that are less than ($S_{T/2}$). K is a sensitivity parameter defined to control the importance of the proximity or distance between $Label(F)$ and sbexpression in the final result. The higher the value of K, the smaller the importance of the distance. If K = 1 means that symmetrical limit semantics are not applied. Then, the evaluations according to the symmetrical limit semantics expressed by g^1 are:

1. $E*(<t5, VH>, d1) = VH, E*(<t5, VH>, d2) = H, E*(<t5, VH>, d5) = H, E*(<t5, VH>, d5) = H, E*(<t5, VH>, d6) = T, E*(<t5, VH > d7) = VH$
2. $E*(<t6, L>, d1) = M, E*(<t6, L>, d2) = M, E*(<t6, L>, d4) = VH, E*(<t6, L>, d6) = L, E*(<t6, L>, d7) = VH$

3. $E*(<t7,H>,d1)=T, E*(<t7,H>,d2)=VH, E*(<t7,H>,d4)=T, E*(<t7,H>,d6)=H, E*(<t7,H>,d7)=H$

The evaluation of sb expression $(t5,VH)\wedge\ (t6,L)$ through Φ with $W=[0.3,0.7]$ is:

1. $E*(<t55,VH>\wedge<t6,L>,d1)=\ \Phi\ (VH,M)=\ H;\ 2.E*(<t5,VH>\wedge<t6,L>,d2)\ =\ \Phi\ (H,M)=M$
2. $E*(<t5,VH>\wedge<t6,L>,d4)=\ \Phi(N,VH)=VL;\ 4.E*(<t5,VH>\wedge<t6,L>,d5)=\ \Phi\ (H,N)=VL$
3. $E*(<t5,VH>\wedge<t6,L>,d6)=\ \Phi\ (H,L)=M;\ 6.E*(<t5,VH>\wedge<t6,L>,d7)=\ \Phi\ (H,VH)=H$

Finally, the complete query is evaluated by using the operator Φ with $W=[0.7,0.3]$*:*

1. $E*(q,d1)=\ \Phi\ (H,T)=\ EH;\ 2.E*(q,d2)=\ \Phi\ (M,VH)=H;\ 3.E*(q,d4)=\ \Phi\ (VL,T)=VH$
2. $E*\ (q,d5)=\ \Phi\ (VL,N)=EL;\ 5.E*\ (q,d6)=\ \Phi\ (M,H)=H;\ 6.E*\ (q,d7)=\ \Phi\ (H,H)=H$

It is demonstrated with the result obtained, when making use of the operators Max and Min are less strict, with which the following result is obtained.

$$[RSV1=T, RSV2=VH, RSV4=T, RSV5=N, RSV6=H, RSV7=H]$$

The operator LOWA, when applied to model the evaluation of the neutrosophic connectives AND and OR in the evaluation process of the consultations, indicates that it is in front of the use of the Soft-computing techniques, which are introduced in the recovery of the information and contribute to eliminate the too strict evaluation of the operators that model the neutrosophic connectives, which is useful in the treatment of the uncertainty.

Conclusion

In this paper, the neutrosophic linguistic modeling was presented for the treatment of uncertainty in the recovery of information based on an ordinal neutrosophic linguistic approach that accepts linguistic weighted Boolean consultations. This neutrosophic linguistic modeling takes advantage of the property of being an operator of the LOWA operator, used to aggregate ordinal linguistic information. The LOWA operator is applied to model the evaluation of the logical AND and OR connectives in the query evaluation process. In this way, Softcomputing becomes effective in the retrieval of information and it is possible to eliminate the too strict evaluations of the operators that model the neutrosophic connectives, which is advantageous in the treatment of uncertainty.

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Received: January 11, 2019. Accepted: May 15, 2019

Use of neutrosophy for the detection of operational risk in corporate financial management for administrative excellence

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Abstract. Operational risk is linked to the financial risks of companies. Financial risks are identified as credit risk, liquidity risk, market risk and operational risk, and they significantly affect the operations and results of entities, particularly those with investments. The measurement of operational risk in a qualitative manner implies probability associated with a potential loss of resources, which are linked to the economic and financial management of the institutions. For an adequate detection of risks, techniques, tools and methods applicable to knowledge must be used, such as Neutrosophy, which is favorable for interpreting knowledge that comes from linguistic terms. For this reason, the objective pursued in this work is to detect the operational risk in corporate financial management, for administrative excellence through the use of Neutrosophy.

Keywords: Financial risk, administrative excellence, business success, decision making, profitability - risk, Neutrosophy.

1 Introduction

Operational risk contributes to the uncertainty boom. Factors contributing to this uncertainty are diversification of activities and complexity of new products, complexity of mergers and acquisitions of products, complexity of new sales channels, large-scale globalization, automation of processes, outsourcing of activities and, above all, constant regulatory changes in institutions [1].

One definition of operational risk that leads to uncertainty was that of [2], which refers to operational risk as a changing, dynamic and complex process in the environment of financial institutions. Characteristics that lead to uncertainty due to its dynamism.

In accordance with the present concern with operational risk and the uncertainty associated with it, there was motivation on the part of the British Banker Association for the emergence of the first risk regulation through internal models. Subsequently, the second consultative document for the new Basel Accord was created, which established a causal definition, risk of loss arising from inadequate or failed internal processes, people or systems or from external events.

This type of risk includes legal risk, but excludes strategic, systematic and reputational risks, as well as the opportunity cost associated with operational failures and indirect losses, due to their difficult quantification. Therefore, it was demonstrated that operational risk is an element that can result from internal (related to errors in processes, systems and people) or external events.

The operational risk to be identified, in an institution, requires two parameters that characterize it and contribute to its quantification, these parameters are:

- Severity or amount of loss
- Frequency or probability

For the detection of operational risk, in corporate financial management for administrative excellence, it is required to treat the category present in it, which is uncertainty. In order to do this, it is necessary to follow a process that begins with the realization of controls, in order to concretize the objectives of risk management and determine the most relevant factors; consequently, initiatives that articulate efforts and responsibilities are required [3]. The characteristics of these controls are dined in a Database, which is useful for the stored results to offer an adequate response on the information needs requested and, in particular, on the probability of present operational risk.

The authors [4], refer that the database for the detection of operational risk should include information about the amount of loss reported, the description of the event that caused the operational risk, the type of event, the business unit to which it corresponds, the date of the loss and the time when it was recorded, the date on which the event ended, management actions taken, recovery (insurance and other mechanisms) and loss estimation adjustments.

Once the data are obtained, risk indicators are designed, defined from the information stored in the Database, in order to reflect the exposure to risks in a specific institution. The combination of these indicators and the rest of the data stored will reveal a risk profile, at the desired extraction level, paying attention to those activities that require greater vigilance. The role of these indicators, in terms of monitoring and control, is fundamental. To this end, they must be combined with control diagrams.

Based on the above, this paper proposes the use of neutrosophy for the detection of operational risk in corporate financial management. For administrative excellence, in particular the neutrosophic logic is used because it allows financial risk analysis with a more structured view of operational risk when the information available is uncertain. Neutrosophic logic provides a rigorous theoretical framework for the treatment of vague, incomplete and subjective information or the treatment of qualitative information, which is a constant in the analysis of financial risks and many real-world problems.

Neutrosophic logic is an extension of Fuzzy logic that was created by Zadeh, as an extension of classical or Boolean logic, to allow the modeling of processes that possess a certain degree of uncertainty. The neutrosophic logic offers a different vision to the one given by the classic logic, it constitutes a tool that allows obtaining numerical values from qualitative variables in most of the financial models, it is defined as a domain integrated by variables associated to a neutrosophic set of values through a function of belonging.[5]

Neutrosophic logic is flexible and tolerant of data imprecision. It is based on natural language and can be constructed from expert knowledge. The elements that form part of a set to a certain degree are called the degree of belonging [6]. Each variable that intervenes as a hypothesis in a rule has a domino associated with it, which can be divided into the number of neutrosophic conjunctions that the expert considers appropriate. All these partitions have a linguistic variable associated with them.[7]

This technique is a multivalued logic, by means of which the notions of human thought and more common in natural processes are considered as frequent, very frequent or infrequent, and can adopt a mathematical formulation.

2 Preliminaries

In this section, we briefly review Neutrosophic Numbers and Neutrosophic Matrix concepts. Afterwards, we shall present relations amongOperational risks and Neutrosophic Cognitive Maps.

2.1 Neutrosophic Number and Neutrosophic Matrix

A statistical neutrosophic number is a number of the following form [8]:

$$N=d+i \quad (1)$$

Where d is the determined part and i is the indeterminate part [9]. For example s: a=1+I if i∈[5,5.4] the number is equivalent to a∈[6,6.4].

A neutrosophic matrix, on the other hand, is a matrix where the elements a = (a_{ij}) have been replaced by elements at $\langle R \cup I \rangle$, where $\langle R \cup I \rangle$is an intiger neutrosophic ring [10].

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A neutrosophic graph is a graph in which at least one arc is a neutrosophic arc [11]. The neutrosophic adjacency matrix. The arcs mean: 0 = no connection between nodes, [0,1] = connection between nodes, I = indeterminate connection (unknown if it is or not). Such notions are not used in fuzzy theory, an example of which is shown below:

$$\begin{matrix} 0 & 0 & I \\ I & 0 & 1 \\ 1 & 0 & 0 \end{matrix}$$

An Special kind of neutrosophic matrix is a neutrosophic cognitve Map. A static analysis on neutrosophic cognitive maps according to[12] gives as initial result a neutrosophic number of the form$(a + bi)$, where I= indetermination). This result requires a process of de-neutrosification, as proposed by Salmerón and Smarandache . In the De-Neutrosification process, indetermination belongs to the interval 0 and 1, which is represented as; $I \in [0,1]$ [13].

2.2 Operational risks and Neutrosophic Cognitive Maps

To determine the operational risks in corporate financial management that often affect administrative excellence, a problem tree is used in this paper, as the technique that facilitates the identification and organization of the main causes and effects of operational risk in financial management. The problem tree is a technique that has as its fundamental logic; that each problem is the effect of the causes that appear below it and, in turn, is the cause of those that are on top, and it reflects the interrelationship between causes and effects.

Then a neutrosophic cognitive map [14] is used to interpret the causes and effects that have the greatest impact on the detection of operational risk in corporate financial management for administrative excellence. Neutrosophic cognitive maps are a generalization of Fuzzy cognitive maps, they are introduced by Axelrod [5], where nodes represent concepts or variables in a determined study area and arcs indicate positive or negative influences, which are considered causal relationships. They have been applied in different areas, especially in decision support and in complex systems analysis according to [6] [7].

For the analysis and detection of the causes and effects of greater incidence in the detection of the operational risk of business financial management, for administrative excellence a documental analysis of the different governing documents in the economic systems was carried out, analyzing the following aspects:

- Inadequate management of assets and liabilities
- Excessive granting of credit
- Misalignment of time limits and fees
- Volatility of captured resources
- Associative instability and capital volatility
- Concentration of catchments
- Exogenous causes
- Market risk

According to the analysis of the aforementioned aspects, the main causes are obtained - effects that cause operational risks in business financial management for administrative excellence, which significantly affect administrative excellence.

3 Case Study

He causes - effects, derived from the problem in question are obtained from the documentary analysis carried out, they are shown in the problem tree in Figure 1.

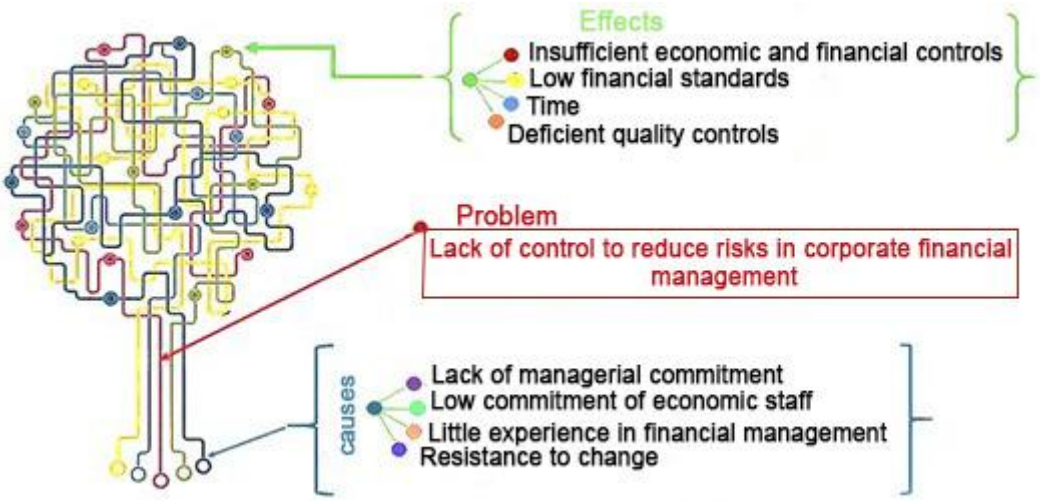

Figure 1: Tree problems of the main causes - effects on the risk of financial management. Source Own preparation.

The main causes - effects in the detection of the operational risk of the business financial management for an administrative excellence, represented in the problem tree highlights as a fundamental problem, the lack of existing control to diminish the operational risk. The causes - effects are presented in linguistic terms, which need to be interpreted.

For the interpretation of the linguistic terms, associated to the causes - effects of the operational risk - effects of the enterprise financial management for an administrative excellence, it is used in the present work the neutrosophic cognitive maps, those that contribute to obtain a greater interpretability of the data, to diminish the uncertainty associated to the operational risks with the purpose of supporting the decision making.

Neutrosophic cognitive maps, as a tool for the modeling of characteristics related to causes - effects on the detection of operational risk of business financial management, for administrative excellence, focus on the selection of concepts that play an important role in the modeling system [15]. This selection is based on the adjacency matrix that takes into account the absolute value of the weights [9].

Indetermination is replaced by maximum and minimum values. Essentially, to perform a static analysis on a neutrosophic cognitive map the steps shown in figure 2 must be followed.

Figure 2: Steps to follow for static analysis in a neutrosophic cognitive map. Source: [13].

The evaluation of the most important causes in the detection of operational risk in corporate financial management, for administrative excellence through a neutrosophic cognitive map, is obtained once the neutrosophic cognitive map is constructed. The neutrosophic adjacency matrix generated is shown in Table 1.

	Cause 1 (lack of managerial commitment)	Cause 2 (low commitment of economic staff)	Cause 3 (little experience in financial management)	Cause 4 (reluctant to change)
Cause 1 (lack of managerial commitment)	0	0	-0.3	0
Cause 2 (low commitment of economic staff)	0	0	0	0
Cause 3 (little experience in financial management)	0	I	0	0
Cause 4 (reluctant to change)	0	0	0	0

Table 1: Neutrosophic adjacency matrix. Source: Own elaboration.

Centrality measurements are calculated through Outdegree and Indegree measurements. The Outdegree calculation is obtained from the sum of the rows in the neutrosophic adjacency matrix. To obtain the Indegree result, the columns are added together in the neutrosophic adjacency matrix. These results reflect the strength of

the outgoing relations of the variables of the rows and columns of the neutrosophic adjacency matrix. The result is shown in Table 2.

Causes	ID	OD
Cause 1 (lack of managerial commitment)	0	0
Cause 2 (low commitment of economic staff)	0	0
Cause 3 (little experience in financial management)	0.3	I
Cause 4 (reluctant to change)	0	0

Table 2: Measures of centrality, Outdegree, Indegree. Source: Prepared by the authors.

Once the centrality of the rows and columns that make up the neutrosophic adjacency matrix is obtained, the total centrality is calculated, which is no more than calculating the sum of the Indegree and the Outdegree of the variable ones. Once the measures of centrality have been calculated, they are classified and incorporated into the neutrosophic cognitive map as nodes, the result shown in Table 3.

	Transmitter Node	Receiving Node	Ordinary
Cause 1 (lack of managerial commitment)			X
Cause 2 (low commitment of economic staff)	X		
Cause 3 (little experience in financial management)	X		
Cause 4 (reluctant to change)			X

Table 3: Classification of the nodes. Source: Own elaboration.

According to the results shown in Table 3, the nodes classified as Cause2 and Cause3 are transmitters and the nodes Cause1 and Cause4 are ordinary nodes. The total centrality is then calculated by adding the obtained Outdegree and Indegree values. The total result, obtained for each node representing the neutrosophic cognitive map, is shown in Table 4.

	Transmitter Node
Cause 1 (lack of managerial commitment)	0
Cause 2 (low commitment of economic staff)	I
Cause 3 (little experience in financial management)	0.3+I
Cause 4 (reluctant to change)	0

Table 4: Total centrality. Source: Own preparation

The next step is the process of de-Neutrosification as Salmeron and Smarandache refer to [12] $I \in [0,1]$ is replaced by maximum and minimum values. Table 5 shows the interval values.

	Td
Cause 1 (lack of managerial commitment)	0
Cause 2 (low commitment of economic staff)	[0,1]
Cause 3	[0.3,1.3]

(little experience in financial management)	
Cause 4 (reluctant to change)	0

Table 5: From - Total nitrification of the total centrality values. Source Own elaboration.

Finally, we work with the mean of the extreme values, which is calculated through equation 5, useful to obtain a single value according to [16]. Value that contributes to the identification of the most incidental causes of operational risk in corporate financial management for administrative excellence.

$$A > B \leftrightarrow {}^{(a_1 + a_2)}/_{2} > {}^{(b_1 + b_2)}/_{2} \quad (2)$$

Then;

$$\lambda([a_1 + a_2]) = {}^{(a_1 + a_2)}/_{2} \quad (3)$$

Based on equation 5, the median of the extreme values is obtained in order to analyze the factors with the greatest incidence with respect to operational risk in corporate financial management for administrative excellence. The results are shown in table 6.

	Td
Cause 1 (lack of managerial commitment)	0
Cause 2 (low commitment of economic staff)	0,5
Cause 3 (little experience in financial management)	0,8
Cause 4 (reluctant to change)	0

Table 1: Median of extreme values. Source Own elaboration.

The most incidental causes of operational risk in business financial management for administrative excellence are:

Cause 3 (little experience in financial management) > Cause 2 (low commitment of economic staff) > Cause 1 (lack of managerial commitment) > Cause 4 (reluctant to change).

The results obtained show that the causes that have the greatest impact on the operational risks of corporate financial management for administrative excellence are those associated with the few experiences in financial management, then the few commitments that have the economic staff of the institutions and then the lack of managerial commitment that leads them to be reluctant to change. The results obtained are in accordance with the incident factors and the central problem shown in the problem tree in Figure 1.

The causes - effects related to the detection of operational risk in business financial management for administrative excellence, made it possible to know the financial impact of the institutions in a general way, which they currently have, obtaining the following results:

a) Identification and evaluation of operational risk in corporate financial management, in order to determine which are the most significant and which are not.

b) The quantification of operational risks in financial management according to the causes - effects shown in figure 1, was based on the financial impact caused in the institutions, which were expressed in monetary terms. This quantification of risks contributed to determine the relative importance of these risks within the financial structure of the institutions, as well as to obtain the necessary information to help improve the combination of economic tools to be used for risk management.

c) To counteract the present problem, action plans were prepared by senior management, which determined the measures to be taken in the face of faults caused by risks in financial management:

- Liquidity in the markets

- Early cancellation of contracts
- Maintenance of unused open lines of financing
- The establishment of an adequate diversification both in terms of terms and sources of funding.
- The establishment of a maximum limit on the total number of open positions

Conclusion

Operational risks in financial management, which have been characterized by a domain of pre-selection, at the level accepted by society, contribute to refer to the main causes - effects that are caused by the environment, technology, human beings, organizations and the political sector. That is why in the present work were identified, through a tree of problems - causes - effects, relative to the lack of control to reduce operational risks. The causes - effects identified were quantified through the use of neutrosophic cognitive maps, which facilitated the measurement of the financial impact of the institutions, in terms of the detection of operational risk, in business financial management for administrative excellence. Future work will concentrate in the development of a software tool to automate the process.

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Received: January 10, 2019. Accepted: May 8, 2019

Cased-based reasoning and neutrosophic logic to identify the employment limitations for Law school graduates at UNIANDES Ibarra

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Abstract. The objective of this study is to identify the employment limitations for Law school graduates at UNIANDES Ibarra, depending on their competencies and functions. For that purpose, we analyzed theoretical referents addressing the follow-up programs for higher education graduates. Moreover, we applied field descriptive investigation with a quantitative approach for an integrated sample of 122 Law school graduates, using questionnaires as instruments, as well as making a statistical descriptive analysis, given the previously executed qualitative analysis, which facilitated data interpretation. After making use of case-based reasoning to obtain the main employment limitations affecting Law school graduates, these limitations are analyzed using Neutrosophic logic in order to recommend and correct the more urgent limitations Law school graduates have to deal with, so that these graduates can start working as soon as possible.

Keywords: Professional skills, Law school graduates, employment limitations, higher education graduates follow-up, case-based reasoning, Neutrosophic logic.

1 Introduction

Graduates tracking is a process that has acquired great importance for higher education over the last times. The first registered antecedents go back to XIX century, when, for example, in the European and North American models, they made emphasis in achieving that graduates acquired a profile meeting the requests of society, trying to guarantee their effective incorporation to the working market, which requires a follow-up from the institution.

In addition, during the Second World War, in developed countries, they remarked the need to evaluate the competences of higher education graduates and its repercussion in the working markets. During the second half of the XX century, with the emergence of communication systems, the production and the administration, the relations between the countries and consequently their working interchanges were transformed [1].

From the year 2000 on, they have been monitoring graduates' performance repercussion to integrate the business environment. An aspect that has become a topic of special interest, since it is tightly related to the competencies approach. Even though it was first mentioned a few years before, specifically in the book Aspects of the Theory of Syntax by Noam Chomsky [2], published in 1965, competences approach starts to be applied frequently in universities during the ’70s.

Author [3], considers that competence is what explains and predicts the conduct of the ideal subject and proposes to describe it by means of the elaboration of a grammar that he called generative. Right from its beginnings, the use of competences also becomes associated with other life activities, such as corporate and businesses world.

Based on the facts previously stated, they use the term professional competences due to its relation with the search of a better qualification to assume specific tasks in a certain job. [4] and [5] appeared in the psychology research carried out in the University of Harvard, who, through the publication of a paper namely: Testing Competence Rather than Intelligence, defined the competence as the main characteristic related to the efficient performance of a person at work.

In Ecuador, professional competencies are supported by the revision of the educational quality, which demanded the implementation of mechanisms to monitor graduates activities, tasks, performance, positions, roles and functions. The implemented mechanisms opened new spaces for institutional self-evaluation. In particular, these spaces initialized at the University of Loja (UNL) in 2005, with the first officially graduates [6].

The aforementioned mechanisms are based on what is established by the Organic Law of Higher Education , where is considered the instrumentation of a follow-up professionals for their respective evaluation. These mechanisms are operationalized through the Council for the Evaluation, Accreditation and Quality Assurance of Higher Education (CEAACES), through the processes of evaluation and accreditation of Higher Education Institutions and their academic offers.

It is worth highlighting that the Regional Autonomous University of Andes (UNIANDES) constitutes a paradigm of the mentioned above. This university has a graduate's follow-up program, keeping in touch with the graduates through a Web site, offering the possibility to register, access to services, find employment options and access to a list of employers. For UNIANDES Ibarra extension, tracking of the graduates constitute a valuable source of information that generates a communication network between the forming institution and the graduates, inasmuch as the professionals' accumulated experience allows obtaining data about the working situation, training needs, postgraduate studies requirements and level of professional satisfaction.

Results obtained from graduate's follow-up make possible to adjust career and imparted programs through curricular update. However, considers that UNIANDES follow-up program has some faults because it does not gather all the information required by the academic instances.

According to the above mentioned, graduates, follow-up is a need for all Higher Education institutes in Ecuador. Although, it is evident that important efforts are being made, since systematic methods are applied to meet the characteristics and requests of the students and those of the community contexts.

The previously stated is corroborated with the results obtained by UNIANDES Ibarra, in the IV Encounter of Graduates in 2017, in which the generated information became a first-rate asset for the university. Standing out lately, as a reference for the rest of the higher education institutes in Ecuador, useful to describe the graduate's employment options and, especially those of Law school, given the competences and functions of graduates that took part in the IV Encounter of Graduates UNIANDES Ibarra.

In the same scenery, it was analyzed and demonstrated the good preparation of graduates through the results obtained from different projects, especially, taking as a reference the Career After Higher Education project; an European Research Study, in which they analyzed the working competences of thirty and six thousand graduates during three consecutive periods. This project was implemented in the National University of Colombia, op. cit.

Also, in the before related encounter, they made an analysis of the results from several projects, especially taking into account the project that it was implemented in Europe in 2000, known as Tuning project, which reached numerous countries in Latin America. Continental initiatives were also taken into account; they were analyzed with the implementation of the Reflex project in 2004, (The Flexible Professional in Knowledge Society). In a similar way, they analyzed the initiatives coming from the Proflex project (Flexible Professional in Knowledge Society)[7] for European and Latin American countries.

On the other hand, studies addressing the follow-up of higher education graduates were carried out, standing out the ones from, and at the Central University of Ecuador, at the Pontifical Catholic University of Ecuador (Quito) and at the Regional Autonomous University of Andes, respectively. These studies revealed the importance of programs related to the monitoring of graduates, the authors proposed the use of advanced technological resources and management strategies to improve the professional skills of graduates.[8]

In the universities of the Americas (UDLA) and in the Inter-University Centers for Development (CINDA), in 2015, [6], studies with results relative to the graduate's follow-up were carried out. In these studies, they highlighted the contribution of these follow-ups to the adjustment of the university courses, allowing being aware of the weaknesses and existent strengths and the development of curricular programs.

The perceptions and opinions on the connections between higher education and the working world allude to the preparation of the students for their insertion into the society of the apprenticeship, economic and social internalization, attention to generic or transversal competencies, social skills and to the development of their talents. That is why the demands of the universities in the international environment have influence in the fortification of the evaluation of university activities, which constitutes a way to compensate society.

At UNIANDES Law School, the previously mentioned follow-up, contributes to the formation of professionals for the solution of juridical problems in social, economic and political sectors, in the administration of justice. Moreover, it produces fourth level human resources with competences for the criticism, reflection, analysis and solution of problems in particular juridical contexts. Given the transcendence of the Law school, it is necessary to know how the graduates from this course must have abilities to create, interpret and apply the Law, to intercede and facilitate the resolution of social conflicts and the improvement in reconciliation mechanisms.

Studies indicate that the Law school graduates must possess a dynamic society; they must be prepared to struggle for the application of justice sustained in value, ethical principles, democracy, solidarity and human rights. The evaluation of these graduates is essential to validate that they are ready to go into the working world.

Based on the completed study, the obtained results from the projects; Reflex (The Flexible Professional in Knowledge Society), Proflex (Flexible Professional in Knowledge Society), in the project that was implemented in Europe in 2000, known as Tuning project and that included countries from Latin America[8], in the Career After Higher Education project; A European Research Study, that was a reference for the Ecuadoran universities, as well as the IV Encounter of Graduates in 2017, at UNIANDES Ibarra. All that data were stored in a database, which was classified as a Knowledge Base to analyze the limitations that most affect Law school graduates when inserting themselves into the working world.

The obtaining of such limitations was made through case-based reasoning, which is an Artificial Intelligence technique and a paradigm of solution for problems based on the use of previous experiences to solve new problems. That's why it is used in this work to find the main limitations of Law school graduates in the Ecuadoran universities when they go into the working world, given the stored characteristics in the Base of Cases related to the results of the previously mentioned projects.

The case-based reasoning is very useful since with this technique it is possible to measure experiences in previous situations and use them later in present situations. So to say, a new problem is solved by searching in the previously created Database/Case Base, where a similar case was solved in the past. Afterwards a suggested solution is evaluated, taking into account the formerly solved cases, to try to apply the same solution to the current problem .

Once the main limitations of Law school graduates are obtained, neutrosophic logic[9] is used to treat the limitations that most affect Law school graduates when they enter the working world. Neutrosophic logic derives from Neutrosophy, new branch of philosophy that studies the origin, nature and scope of neutralities created by [10] Neutrosophic logic and sets constitute a generalization of fuzzy logic and sets [11], and especially of the intuitionist logic of , with multiple applications in the decision-making field, images segmentation and machine learning[12].

2 Materials and methods

In this work, a descriptive field investigation with a quantitative approach was carried out [1], with the objective of investigating and describing the relevance of Law school in the next five years, the graduate's employment options and their competences and functions; for which primary relevant data were obtained. The selected sample consisted of 122 Law school graduates at UNIANDES Ibarra. The sample selection

was not probabilistic and the selection criterion was to consider all graduates participating in the encounter of graduates that took place in 2017. The instrument we used to gather the information was a questionnaire designed by UNIANDES, which was adjusted and structured in three dimensions:

1. Trends in the Occupational Market: containing four questions.
2. Occupational Demand (employability): inquires about five aspects.
3. Training and feedback: addresses one aspect.

Descriptive statistics tools; analytic and relative frequency, served as data analysis technique [13]. The obtained figures were analyzed by means of the theoretical principles sustaining the study. Once the results of the three measured dimensions in the questionnaire designed by UNIANDES Ibarra were obtained, they were compared with the results stored in the previously created Case Base, to save the main limitations and deficiencies of Law school graduates. The comparison was carried out through a case base reasoning[14], from which we obtained the main limitations for Law school graduates when they enter the working world.

The limitations for Law school graduates were analyzed through neutrosophic logic, assigning a linguistic scale of single value to each limitation, to facilitate the knowledge of, how bad or how well the graduates are or how great the graduates are, or how badly the graduates are, among other linguistic terms of interest. The procedure to be followed is shown in Figure 1, which represents the workflow to measure the employment limitations of Law school graduates in Ecuador and indicates which are the ones that need to be corrected the most.

The proposed workflow is based on the proposal of [15], for knowledge-based recommendation systems, which allows representing linguistic terms and indetermination by means of single valued neutrosophics numbers (SVN).

Definition 1. Let X be a set of objects and $x \in X$ represents a single valued neutrosophic number (SVN) and is characterized by a vector (V, I, F) where V indicates truth-value, I indeterminacy-value and F falsity-value.

Single Valued Neutrosophic Set (SVNS) concept permits the application of neutrosophic set theories on many real world scientific and engineering applications [13], see definition1. Many studies have been done on this theory and have been used in many application fields. In SVNS values of truth, falsity, and indeterminacy of a situation are considered. Many uncertainties and complex situations arise in decision-making applications where id useful to model using SVNS [16-18].

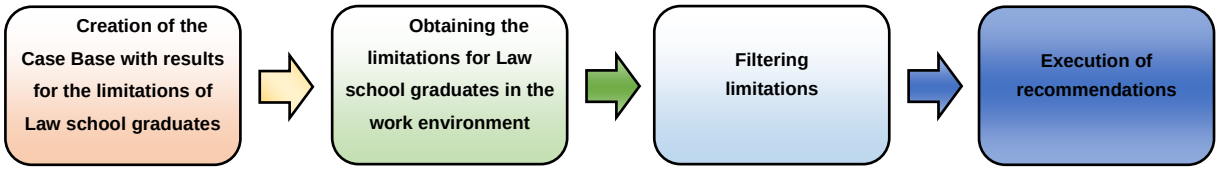

Figure 1. Workflow to measure Law school graduates limitations in Ecuador.

The detailed description for each activity and the workflow to measure the limitations of Law school graduates in Ecuador, supporting the proposal to indicate which are the limitations that need to be corrected the most, is presented below.

1. Creation of the Case Base with results for the limitations of Law school graduates

Each one of l_i limitations is described by a set of characteristics that will represent the limitations for Law school graduates in Ecuador.

$$A = \{a_1, \dots, a_k, \dots, a_l\} \quad (1)$$

In order to obtain the limitations for Law School professionals in the working environment through a Case Base, neutrosophic single value numbers (SVN) are used [19]. Where $A* = (A1*, A2*, .., An*)$ be a regular vector SVN, such that $Aj* = (aj*, bj*, cj*)$, $j = (1,2, \dots, n)$ y $Bi = (Bi1, Bi2, \dots, Bim)$, $(i = 1,2, \dots, m)$; Let it be *m* vectors of *n* SVN numbers such that y $Bij = (ij, bij, cij)$ $(i = 1,2, \dots, m)$, $(j = 1,2, \dots, n)$ then the Euclidean distance is defined as Bi y $A*$ according to the expression 2, defined by [20] .

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

Based on Euclidean distance, according to [21], a measure of similarity can be defined. The closer alternative Ai is to the limitations of Law school graduates in Ecuador once they enter the working world (si), the greater the similarity, which allows establishing an order between alternatives .

The employment limitations for Law school graduates in Ecuador are obtained directly from Case-Based Reasoning. The assessments of the limitations of those Law school graduates in Ecuador who entered into the working world are defined by aj. They are expressed by using the linguistic scale S, $v_k^j \in S$, where $S = \{s_1, \dots, s_g\}$ is the set of defined linguistic terms to evaluate the characteristics c_k using the SVN numbers.

The linguistic terms to be used are defined once the set of limitations $A = \{a1, \dots, aj, \dots, an\}$ has been described and subsequently these limitations are saved in the previously created Database, to be taken as new cases to be evaluated.

2. Obtaining the limitations for Law school graduates in the work environment

In this step, we obtain the information about the kind of work done by Law school graduates in Ecuador. When the main limitations of these graduates entering the working world are known, they are represented as follows:

$$P_e = \{p_1^e, \dots, p_k^e, \dots, p_l^e\} \quad (3)$$

These limitations are integrated by a set of attributes that are represented by:

$$C^e = \{c_1^e, \dots, c_k^e, \dots, c_l^e\} \quad (4)$$

where: $c_k^e \in S$

3. Filtering limitations

In this step, limitations are filtered according to the profile or knowledge areas related to the Law, according to these graduates' positions, in order to find which are the limitations that have a significant impact on the work they do and their performance. For this purpose, the similarity between the limitations according to the areas of knowledge where Law school graduates work is calculated, Pe and each aj limitation in general is stored in the Case Base. Equation 5 is used to calculate the total similarity [14].

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

Function S calculates the similarity between the values of the attributes of limitations for Law school graduates according to a specific knowledge area and the limitations of Law school graduates in general, entering the working world, a_j,.

4. Execution of recommendations

Once the similarity between the limitations of Law school graduates is calculated, which are stored in the Case Base and defined each limitation for Law School graduates according to the area of knowledge where they work, they are ordered according to the similarity obtained and are represented by the similarity vector, according to expression 6.

$$D=(d_1,\ldots,d_n) \quad (6)$$

Limitations to take into account will be those that best meet the needs of Law school graduates, that is, limitations with greater similarity.

3 Results

From the analysis of the dimension related to occupational market trends: containing four questions, we can conclude that the academic preparation received by UNIANDES Ibarra graduates has been Very Good, so there is an ample satisfaction in this regard. Consequently, we can assure that the university efficiently contributed to the development of professional skills, which are complemented by attitudes and values, expertise, knowledge and skills that have facilitated their performance in their respective work environments.

On the other hand, it is exposed that Law school graduates agree to change the Law school study plan. In particular, they propose the update of the curriculum in a profession that is constantly changing. This is justified by the curricular review carried out, which is a response to social needs in the context of knowledge development so that there must be coherence between curricular design, social needs and the state of knowledge, as referred by [9].

In [10], it is pointed out that universities, as trainers of human resources, are in constant pursuit of quality in order to ensure that the student has the possibility of appropriation of knowledge and know-how, corresponding to the community of which they will be members, thanks to a training process. On the other hand, the aforementioned author thinks that universities try to ensure that graduates bring to their working environments the general values they obtain from their academic culture.

In the same dimension, the time it takes for a graduate to get a job is analyzed, emphasizing that they take less than a year, which is an encouraging and acceptable figure for the incorporation into the working market for any professional. This result allows us to specify that Law School in this region meets the socio-professional and legal needs of the environment because graduates find spaces where to consolidate their social and economic rights.

As for the aspects related to the occupational demand category, corresponding to the second dimension of the analysis, Law school graduates show some results. Such as being able to enroll in postgraduate studies at UNIANDES, which shows that these graduates continue to trust in the quality of the training programs of this institution, as well as allowing the possibility of continuing to improve in the Law school.

It is noteworthy that postgraduate studies are designed over the base of a thorough understanding of normativity, criticism and its comparison to other realities as referred by [22]. These studies provide the professional with the theoretical and conceptual tools they need to be efficient and with the kind of research that generates new knowledge related to problems on the field of Law. They also contribute to the adaptation of the exercise of this profession to the complex and changing reality.

Training programs offered by the universities, in their different levels, are focused on delivering to society a product endowed with qualities that make it compatible with the most up-to-date working and educational paradigms. The relationship between the formal educational component and the graduate is conceived, as previously stated, in a way that it should broaden its significant content from aspects that go beyond the merely academic.

In the analysis of the sector where Law school graduates work, corresponding to the same dimension, it is noted that most of the lawyers in Ecuador work on their own. There is also evidence of a high percentage of Law graduates who are dedicated to the free exercise of the profession, graduates who are qualified as entrepreneurs because they look for job stability.

Based on the previous analysis, it is noticeable that even though the most of Law graduates work on their own, they look for a way to insert themselves in the working market, in order to progress and sustain their families with their own means. These causes show that the employability indexes in Ecuador for Law school graduates are positive since they demonstrate the ability to meet market requirements and the ability to adapt to the context transformations.

A study concerning the position held by Law school graduates is carried out, from the first dimension, the results prove that these graduates perform their work activities providing legal advice, which involves public and private advice. Likewise, the lowest percentages correspond to executive positions, which indicates that Law school graduates do not hold management positions.

On the other hand, the remunerative levels for Law school graduates are analyzed. In this aspect, it is shown that lawyers' salaries vary from 600 to 1200 dollars. Range from 600 to 800 can be qualified as an income that is above the minimum wage, while, if it reaches 1200, it can be considered an acceptable salary, but still does not equal the remuneration a legal professional should earn.

When it comes to salary ranges, it is important to take into account that the economic crisis in Ecuador affects in a very special way the incorporation of young people into the working market and therefore their remuneration. A problem that, among other reasons, is a consequence of academic training is no longer a guarantee of a well-paid job. In this regard, it is important to refer to what is indicated by[23], when he says that in the professional area there are professions that are saturating the working market. That is why educational institutions must rationalize their academic offer. The unemployment rate is compensated by underemployment, which means that fewer and fewer people have well-paid good quality jobs.

Work experience of Law school graduates was analyzed, showing that the Law school graduates in Ecuador have been for more than 5 years in the last job. Which is a positive indicator that demonstrates the job stability and efficiency of the employees in the fulfillment of assigned functions. These reasons indicate that Law graduates have been able to successfully adapt to the labor field. Likewise, it is a proof that the received university academic training was in accordance with the demands of the market because it favored a balance between the requirements of the market and the competencies of the professional Law field.

In the aspect related to the third dimension concerning to training and feedback, the knowledge areas of Administrative Law stand out as a priority, since law graduates require knowledge about the update of norms and procedures regulating the activities in Public Administration. Then the training area in Public Procurement is also stood out, due to the need for recent theoretical information and practical application in aspects related to public procurement such as budget control, programming, administration and execution of public works acquisitions. Lastly, training in Environmental Law, which is the result of the need to acquire knowledge in a branch of law that is recent and that emerges as a new juridical tutelage interest.

In this area, we find the knowledge to constitutionally regulate the protection of the environment and the ecology, as well as the update interest on the regulations that control the Mining Law.

After obtaining the results, when applying the questionnaire developed by UNINDADE Ibarra, the workflow proposed in Figure 1 is applied to obtain the limitations that affect Law school graduates. For our case study we used the Case Base obtained from the previously created Database. Then we applied Case-Based Reasoning to compare the limitations affecting Law graduates, which are stored in the Base of Cases, and the limitations of Law graduates according to the area of knowledge where they work.

From the comparison we obtained the following limitations:

- Occupational market trends for Law graduates are based on the socio-professional and legal needs of the environment.
- Law school curriculum requires constant update, since it is a profession that is continuously transformed and must be in accordance with the socio-professional and legal environment.
- Occupational demand for Law school graduates is based on the possibility of being able to continue postgraduate studies to improve with regard to Law working environment.
- Most of the lawyers in Ecuador work for their own and devote themselves to the free exercise of the profession.

These limitations are represented in the Case Base as: $A = \{a1, a2, a3, a4, a5\}$, described by the set of attributes C = {c1, c2, c3, c4, ..., c5} valued through the linguistic scale of Table 1, whose valuations are stored in a Case Base.

Linguistic term	**SVN**
Extremely good (EG)	(1,0,0)
Very very good (VVG)	(0.9, 0.1, 0.1)
Very good (VG)	(0.8,0,15,0.20)

Good (G)	(0.70,0.25,0.30)
Moderately good (MG)	(0.60,0.35,0.40)
Medium (M)	(0.50,0.50,0.50)
Moderately bad (MB)	(0.40,0.65,0.60)
Bad (B)	(0.30,0.75,0.70)
Very bad (VB)	(0.20,0.85,0.80)
Very very bad (VVB)	(0.10,0.90,0.90)
Extremely bad (EB)	(0,1,1)

Table 1: Linguistic terms used.

To obtain recommendations on the limitations affecting those Law school graduates who entered the labor world, information expressing the knowledge areas they preferred was provided and they were evaluated, through the linguistic scale of table 1, to obtain linguistic values in accordance to the detected limitations.

According to the linguistic evaluation we made, the tendency of the occupational market for Law school graduates, which is based on the socio-professional and legal needs of the environment, is moderately good (MG). The aspect related to the constant update of Law school curriculum got a very good (VG) evaluation since it is a profession that is continuously transformed and must be in accordance with the socio-professional and legal environment. The occupational demand of Law school graduates is based on the possibility of being able to continue postgraduate studies, to further improve concerning the work environment of Law, obtained a value of very very good (VVG). Finally, most of the lawyers in Ecuador work on their own and devote themselves to the free exercise of the profession, obtained a very good (VG) result. These results are shown through the expression 7.

$$Pe = \{MDG, VG, VVG, VG\} \quad (7)$$

Once obtained the values for the main limitations for Law school graduates in Ecuador, according to the linguistic scale of Table 1, we proceed with the calculation of the similarity between the limitations in general and the specific limitations according to the knowledge area in which these graduates develop once they enter the working world. Results are shown in table 2.

a_1	a_2	a_3	a_4
0.55	0.80	0.38	0.85

Table 2: Similarity between the Law school graduates limitations in general and those according to the knowledge area where they work.

Based on the results obtained and shown in Table 3, it is recommended to pay attention to those limitations according to the knowledge area where Law school graduates work that is closer to the general limitations of these graduates entering the working world. The ordering of limitations is shown in expression 8.

$$\{a_4, a_2, a_1, a_3\} \quad (8)$$

In case of recommending the closest limitations, these would be those corresponding to the vector a_4, a_2, which are related to the constant updating of the Law school curriculum, and Law school graduates who work on their own and devote themselves to the free exercise of the profession.

4 Conclusion

In this study, we described the employment possibilities for Law school graduates at UNIANDES Ibarra. We carried out an analysis from the theoretical referents, which addressed the characteristics of follow-up programs for higher education graduates. We applied a questionnaire developed by UNIANDES Ibarra, which helped us discover

the general limitations for Law graduates entering the working world. Limitations were stored in a Database, and then treated as a Case Base, through Case-Based Reasoning, as an Artificial Intelligence technique. The obtained results were evaluated through neutrosophic logic, in particular making use of a workflow to measure the limitations for Law school graduates in Ecuador. Which facilitated the recommendations of limitations having more influence in Law school graduates in Ecuador, affecting their work performance and the balance between the competencies acquired during their study stage and the working world.

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Received: January 6, 2019. Accepted: May 12, 2019

A Model of neutrosophic recommendation for the improvement of the consents of the ICSID arbitration procedure in Bolivia, Ecuador and Venezuela

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Abstract. This paper analyzes the various aspects related to the denunciation of the Washington Convention of 1965 or Convention on the Settlement of Investment Disputes between States and Nationals of Other States, of the International Centre for Settlement of Investment Disputes (ICSID) by Ecuador, Bolivia and Venezuela. The facts that occurred, the positions of these states to take into consideration the denunciation of the agreement, the consequences of the denunciation and the possible solutions of the actors involved are analyzed through a neutrosophic recommendation model to recommend a solution for the improvement of the consents of the ICSID arbitration procedure in Bolivia, Ecuador and Venezuela.

Keywords: ICSID arbitration procedure, Washington Convention, treaties, neutrosophic model.

1 Introduction

The ICSID is an international private arbitration center of the World Bank, financed by the latter and based in Washington, which settles disputes, either through arbitration procedures or investment conciliation, between governments and nationals of other states party to the 1966 Convention.

The object of ICSID is set forth in Article 1 of the Convention, which states that ICSID shall have the purpose of facilitating the submission of investor disputes between Contracting States and nationals of other Contracting States to a conciliation and arbitration procedure in accordance with the provisions of this Convention [1].

For, arbitration constitutes one of the legal means of peaceful settlement of disputes, together with judicial settlement, whereby a dispute arising between international subjects may be submitted by them to an independent third party to adopt, after an adversarial procedure, a decision based on law binding on the parties terminating the dispute[2].

The first state to denounce the Washington Convention was Bolivia in 2007. Written notification of Bolivia's denunciation of the agreement was sent to ICSID in accordance with article 71 of the agreement, which provides that any contracting state may denounce this agreement by written notification addressed to the depositary of the agreement. Upon denunciation, such denunciation shall take effect six months after receipt of such notification.

The second state to denounce the Washington agreement was Ecuador, which did so by signing a decree that denounces and therefore declares the agreement with ICSID terminated. In this sense, it was alleged that there was a conflict in relation to the new political constitution of that country. The same in correspondence with the International Centre for Trade and Sustainable Development (ICTSD).

The third state was that of the Bolivarian Republic of Venezuela. The notification was sent officially in writing, expressing the denunciation of the Bolivarian Republic of Venezuela of the Convention.

The aforementioned states denounced, in particular, the treaty, alleging various reasons as referred to [3]. Among the main reasons are:

- Arbitrary conduct or partial interpretation by ICSID arbitrators, for reasons of erroneous application of the law, highlighting the following obstacles:

. Exacerbated of the autonomy of the ICSID system, which did not allow the revision of its awards.

. Applicability of minimum standards of international law regardless of the will of the parties, which can be used for the violation of the latter.

. The granting of too many guarantees to investors, without them being sufficiently delimited.

- Defense of the sovereignty of natural resources. In this declaration it was pointed out the decision that the states that belong to ALBA, agreed to withdraw and denounce in a joint way the convention of the ICSID, with the guarantee of the sovereign right of the peoples to regulate the foreign investment in their territories. Specified within the rejection of the countries belonging to ALBA, the following:

. Pressure from transnational companies that, having violated constitutional norms, national laws, contractual commitments, regulatory provisions, environment and labor, resist the application of sovereign decisions of the countries.

Threats with an incidence of international arbitration lawsuits against states in instances such as the ICSID, according to [1].

The denouncing countries also have legislation in different areas where foreign investor states can resort to the dispute settlement mechanisms established in their own legislation. It is unquestionable that a state, as a party to the convention, has the right to denounce it, being the instrument itself the one that establishes a mechanism to do so; specifically, article 71 is used for this purpose.

By virtue of this denunciation, Venezuela's exit from the ICSID materialized on July 24, 2012, while Bolivia's exit took place in October 2007. The substantial differences incorporated by the Washington Convention into the denunciation of ICSID investment treaties deserve careful analysis. Considering the validity of new laws in the countries under study, which provokes reasons to believe that these countries are the object of different lawsuits.

The effects of perfecting the consent to submit to the ICSID arbitration procedure, for the countries in question were three, which are contemplated in the Washington Convention, these effects are shown below:

1.The consent of the state to submit to ICSID arbitration, which constitutes an irrevocable international legal obligation.

2.The granting by the ICSID tribunals of exclusive and therefore exclusive jurisdiction over the matter.

3.Prohibition for any contracting state to grant, which means diplomatic protection. This aspect is intended not to promote any international claim in respect of any dispute which any of its nationals and any other contracting state has consented to be submitted to arbitration under the Washington Convention.

Based on the foregoing, it should be noted that the contracting states must grant significant aspects of diplomatic protection, stressing that they must not promote any international claim in respect of any dispute that one of their nationals and another contracting state has the consent to submit to arbitration under the Washington Convention, provided that other states have not complied with the award made in such dispute or have failed to comply with it [1]. For this reason, a neutrosophic [4]recommendation model is proposed for the improvement of the consents of the ICSID arbitration procedure in Bolivia, Ecuador and Venezuela [5].

Given that the topic is qualitative and documentary, Neutrosophy is a branch of philosophy [9] that studies the origin, nature and scope of neutrality, as well as its interactions with different ideational spectra. The term neutrosophic comes etymologically from Neutrosophy, which means knowledge of neutral thought, and this third neutral represents the main distinction, i.e. the neutral, indeterminate, unknown part (in addition to "truth" / "belonging" and "falsehood" Components of "nonbelonging" that appear in the fuzzy logic / set).[6]

Neutrosophic sets generalize the fuzzy set (especially the intuitionist set [7]. This paper proposes a model recommendation based on the effects of perfecting consent to submit to the ICSID arbitration procedure.

2 Preliminaries

2.1 Neutrosophic Sets

Neutrosophic recommendation models are useful in the decision-making process as they provide a set of options that are expected to meet desired expectations [5, 8]. This model, in the present work, is based on the effects caused by the submission to the ICSID arbitration procedure, contemplated in the Washington Convention, is a scheme that questions the current order, a formula or a singular approach that its proponents perceive as novel [9].

For this work is particularly important the definition 1 of neutrosophic sets as defined in [13], [12], [27].

Definition 1. Let M a neutrosophic set in universe X characterized by a triple $(Label, X, \mu_M(x), \tau_M(x), \sigma_M(x))$ where: *Label* is a linguistic term which represents the name of set, X represents the universe of discourse, $\mu_M(x) \in [0,1]$ represents a membership function , $\tau_M(x) \in [0,1]$ represents a indeterminacy-membership function and $\sigma_M(x) \in [0,1]$ represents a falsity-membership function, where $0 \leq \mu_M(x) + \tau_M(x) + \sigma_M(x) \leq 3$.

This definition implies that for each value of the domain $x \in X$ when evaluated in neutrosophic set M, such that $M(x)$ should returns the value $(\mu_M(x), \tau_M(x), \sigma_M(x))$. First component represents the membership degree of the value x to the set M, second component represents the indetermination degree of the value x to the set M and the third component means the non-membership degree of the value x to the set M [10].

2.2 Single Valued Neutrosophic Number

For the use of the set of single-value neutrosophic numbers the effects of perfecting the consent to submit to the ICSID arbitration procedure were called X which constitute the universe of the set of

Definition 2. A single-value neutrosophic numbers A on X, is an object that is composed as shown in expression as follows:

$A = \{\langle x,uA(x),rA(x),vA(x)\rangle: x \in X\}$ d (2)

Where:

$uA(x): X \rightarrow [0,1]$, $rA(x): X \rightarrow [0,1]$ y $vA(x): X \rightarrow [0,1]$, with $0 \leq uA(x) + rA(x) + vA(x): \leq 3$ for all $x \in X$.

The interval (x), $rA(x)$ and $vA(x)$ represents the membership to true, indeterminate and false of x in A, respectively. An SVN number, for the analysis of the effects of perfecting consent to submit to the ICSID arbitration procedure, in this study, is expressed as $A = (a, b, c)$, where $a, b, c \in [0,1]$, and $+ b + c + c \leq 3$.

The SVN numbers, which are obtained, are useful for recommendation systems[5, 6]. Publications on neutrosophic set theory and SVN numbers and its applications in several fields have been increasing in recent years; evidenced by the works presented in [11-13].

3 Methods

This paper reviews the literature on international investment treaties negotiated by Latin American countries, especially Bolivia, Ecuador and Venezuela, and the effects of their denunciation. For this purpose, the study was carried out on documents and studies carried out by multilateral organizations specialized in the subject and articles and jurisprudence on the subject, since it is a qualitative and documentary subject.

The workflow of the model proposed in the present work, shown in figure 1, is based on the proposal of Cordon [14], in particular for recommendation systems based on knowledge allowing to represent linguistic terms and indetermination by means of SVN numbers.

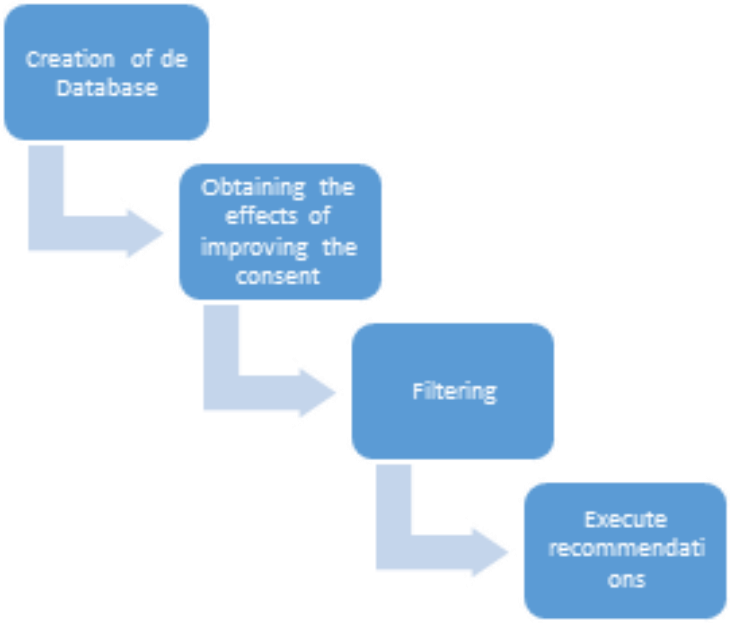

Fig. 1: Model of neutrosophic recommendation for the improvement of the consents of the ICSID arbitration procedure in Bolivia, Ecuador and Venezuela.

The aforementioned procedure analyses the effects of the submission to the ICSID arbitration procedure, in general, for Latin American countries and in particular for the first countries to denounce the Washington agreement, such as Bolivia, Venezuela and Ecuador. The analysis is carried out through the use of knowledge, where the result obtained is a set of linguistic terms which are detailed using the set of single-value neutrosophic numbers (SVN),[6], for a better understanding and recommendation of them.

The detailed description of each of the components of the model that supports the proposal is presented below.

1. Creation of the Database with the effects caused by the arbitration procedure ICSID

Each of the effects are represented by ai they will be described by a set of characteristics that will conform the

effects provoked by the ICSID arbitration procedure which are expressed mathematically as shown in expression 2.

$C=\{c_1,...,c_k,...,c_l\}$ (2)

In order to obtain the database, the effects caused by the ICSID arbitration procedure are obtained using single-value neutrosophic numbers (SVNs) [12,13]. That is, either $A* = (A1*, A2*, ..., An*)$ a vector of SVN numbers such that $Aj* = (aj*, bj*, cj*)$ j= (1,2, ..., n) and $Bi = (Bi1, Bi2, ..., Bim)$ (i = 1,2, ..., m) are m vectors of n SVN numbers such that and $Bij = (aij, bij, cij)$ (i = 1,2, ..., m), (j = 1,2, ..., n) then, the Euclidean distance is defined as:

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

Where Bi and $A*$ is a multiple criteria neutrosophic group value for selection as referred to [15].

From the result of the Euclidean distance a measure of similarity is defined as refers [16]. This measure of similarity to the extent that the alternative A_i is closer to the effects caused by the ICSID arbitration procedure (s_i), the greater the similarity will be, allowing an order to be established between the effects as referred to [17], which is obtained through equation 4.

$$F_{a_j} = \{v_1^j, \dots, v_k^j, \dots v_l^j\}, j = 1, \dots n \quad (4)$$

The valuations of the provoked effects of the arbitration procedure ICSID, a_j, are expressed using the linguistic scale S, $V_k^j \in S$ where $S=\{s_1,\dots,s_g\}$is the set of linguistic terms defined to evaluate the characteristics ck using the SVN numbers. For this, the linguistic terms to be used are defined once the set of effects is described as shown in expression 5, which are saved in the database created.

$$A = \{a1, \dots, aj, \dots, an\} \quad (5)$$

2. Obtaining the effects of improving the consent of the ICSID arbitration procedure

In this component, information is obtained related to the effects of improving the consent of the ICSID arbitration procedure, and they are stored in a database registry.

$$Pe = \{p_1^e, \dots, p_k^e, \dots, p_l^e\} \quad (6)$$

This register will be composed of a set of attributes that are mathematically represented as shown in expression 7.

$$Ce = \{c_1^e, \dots, c_k^e, \dots, c_l^e\} \quad (7)$$

Where: $c_k^e \in S$

The effects of improving the consent of the ICSID arbitration procedure is obtained through the so-called conversational approach as it refers [16].

3. Filtering the effects of improving consent to submit to the ICSID arbitration procedure

In this activity, the effects of improving the consent to submit to the ICSID arbitration procedure are filtered according to the records stored in the Database to find which are the most appropriate. For this purpose, the similarity between the effects of improving the consent of the ICSID arbitration procedure, Pe and each effect aj registered in the Database was calculated. For the calculation of the total similarity, the following expression is used:

$$S_i = 1 - \left(\left(\frac{1}{3}\sum_{j=1}^{n}\left\{\left(\left|a_{ij}-a_j^*\right|\right)^2+\left(\left|b_{ij}-b_j^*\right|\right)^2+\left(\left|c_{ij}-c_j^*\right|\right)^2\right\}\right)^{\frac{1}{2}}\right) \quad (8)$$

The function S calculates the similarity between the values of the effects of the records stored in the Database and that of the general effects, for the countries of Latin America, related to the improvement of the consent to submit to the ICSID arbitration procedure, aj, as it refers [14].

4. Execute recommendations

Calculated the similarity between the effects that were stored in the records of the Database and each of the general effects, for Latin American countries, related to the improvement of consent to submit to the ICSID arbitration procedure, are sorted according to the similarity obtained, represented by the similarity vector that is shown in the expression 9.

$$D = (d1, \dots, dn) \quad (9)$$

The effects to take into account with greater precision will be those that better satisfy the needs of the effects stored in the records of the Database, that is to say, those that have greater similarity.

4 Case Study

The Database created, as component 1 of the proposed model of Figure 1, contains the provoked effects of the ICSID arbitration procedure, whose procedures are represented mathematically as shown in expression 10.

$A = \{a_1, a_2, a_3\}$ (10)

The one that contains the set of attributes that are shown in expression 11.

$C = \{c_1, c_2,, c_3\}$ (11)

The attributes will be evaluated in the following one through the linguistic scale that is shown in table 1. These valuations are stored in the previously created Database.

Linguistic term	SVN Numbers		
Extremely good(EG)	(1,0,0)	Medium Bad (MDB)	**(0.40,0.65,0.60)**
Very very good (VVG)	(0.9, 0.1, 0.1)	Bad (B)	**(0.30,0.75,0.70)**
Very good (VG)	(0.8,0,15,0.20)	Very bad (VB)	**(0.20,0.85,0.80)**
Good(G)	(0.70,0.25,0.30)	Very very bad (VVB)	**(0.10,0.90,0.90)**
Medium good (MDG)	(0.60,0.35,0.40)	Extremely bad (EB)	**(0,1,1)**
Average(M)	**(0.50,0.50,0.50)**		

Table 1: Linguistic terms used [12].

The view of the result of the database of the effects caused by the ICSID arbitration procedure for Bolivia, Venezuela and Ecuador is shown in table 2.

	$c1$	$c2$	$c3$
$a1$	MDB	M	MMB
$a2$	B	MD	MB
$a3$	MMB	M	M

Table 2: Database of the effects caused by the ICSID arbitration procedure. Source: self made

To make a recommendation, the result obtained is analyzed, which is expressed mathematically as shown in expression 12.

$Pe = \{MDG, VG, VVG\}$ (12)

Subsequently, the calculation of the similarity between the effects caused by the ICSID arbitration procedure in a general manner, that is, for the countries of the Americas and the effects caused by the ICSID arbitration procedure stored in the database. The similarity obtained is shown in table 3.

$a1$	$a2$	$a3$
0.60	0.8	0.9

Table 3: Similarity between the effects caused by the ICSID arbitration procedure in the countries of Latin America and between the countries of Bolivia, Venezuela and Ecuador. Source: self made

Once the results of similarity are obtained, it will be recommended to address those effects caused by the ICSID arbitration procedure, generally for the countries of Latin America that are closest to the effect caused in the countries of Bolivia, Venezuela and Ecuador. The ordering of the provoked effects of the ICSID arbitration procedure is: {a1, a3, a2}. In case of a recommendation of the effects caused by the ICSID arbitration procedure that have more similarity, these would be the recommendations: a2, a3. Based on the result obtained, the two

provoked effects of the ICSID arbitration procedure that must be addressed are described. In particular, for all countries in Latin America, it is required to grant exclusive jurisdiction and, consequently, exclusive of any other, to be heard by the ICSID tribunals, as well as the prohibition of any contracting state to grant, which means diplomatic protection, which has the purpose of not promoting any international claim, with respect to any difference that any of its nationals and another contracting state have consented to its submission to arbitration under the Washington Convention.

The case of Bolivia, Venezuela and Ecuador; as complainants of the Convention, they showed their interest in withdrawing from the ICSID since there are other mechanisms to which they say that investors can resort to denouncing, which can have a counterproductive effect of not minimizing the alleged violation of the rights of sovereign states. abandon one of the arbitration forums, which has an important connotation since they would have such states to denounce all the treaties they have in force and all the multilateral treaties, subtracting from the international dispute resolution mechanisms.

It is noteworthy that Bolivia, Venezuela and Ecuador have not been released from possible arbitration lawsuits; they have only been released from possible claims before the ICSID. Its bilateral investment treaties contain clauses that subject the resolution of investor-State disputes to arbitration awards, and in many cases specifically to ICSID, provided that the parties have ratified this Convention.

The common agreement of the parties to submit a difference to their resolution stands out from the ICSID rules. The Washington Convention did not consider that the international treaties were the instruments that enabled the arbitration to the foreign investor. On the contrary, its provisions reflect that the jurisdiction of the center presupposes a contractual arbitration agreement, concluded between the state and the foreign investor, to submit a difference to its resolution.

Conclusions

According to the documentary analysis carried out, it is demonstrated that in Comparative International Law there is no precedent over the interpretation of article 72 of the ICSID Convention, and the subsistence of an arbitration clause agreed in a BIT, after one of the Contracting States has denounced the Convention. The denunciation of Venezuela, Bolivia and Ecuador of deviating from the ICSID has filed requests for arbitration after the Convention has been denounced.

A recommendation is made for the improvement of the consents of the ICSID arbitration procedure in Bolivia, Ecuador and Venezuela through a neutrosophic model which contributed to the confrontation of conflicts arising from international investments and to improve the work towards such conflicts, in order to achieve a qualitative economic development of the countries of all Latin America. All of which contributes to the creation of an environment of legal security in terms of investment and equity between investors and recipients of investment.

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Received: January 6, 2019. Accepted: May 16, 2019

Neutrosophic model based on the ideal distance to measure the strengthening of values in the students of Puyo university.

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Abstract. The formation of values has been a constant concern of humanity throughout history through different theoretical positions and today has become a dilemma of vital importance for the education of new generations. The objective of the research was to propose educational strategies to strengthen the value systems, expressed in the interests and motivations of university students who study Accounting, Auditing and Business Administration through the subjects received and their link with social reality, at the Universidad Regional Autónoma de los Andes, Puyo extension, offering axiological phenomena such as friendship, moral ethics, generosity, solidarity, honesty, responsibility, respect, tolerance and cooperation. In order to measure the strengthening of the values in the students of Puyo University, a neutrosophic model based on the ideal distance is developed. The study was developed on a descriptive basis, using methods, techniques and instruments, documentary analysis, interview, survey and direct observation. The proposal contributes to the strengthening of the integral formation and values of the students.

Keywords: value formation, educational strategies, value systems, neutrosophic model, distance to ideal.

1 Introduction

During man's very existence he has questioned how to be conscious, the meaning of his life, the objectives to be achieved, his motivations, as well as the ends and goals that mobilize his performance and behavior. These and other questions have accompanied the course of the human existence in its practical and transforming activity propitiating the interest of the philosophers towards the axiological problems from the antiquity, considering the beginning of the axiological polemic next to the birth of the philosophy.

The term axiology comes from the Greek axia which means value and logos (study, treatise). Historically in the study of the nature of values, there have existed different philosophical positions: bourgeois philosophy characterizes the idealistic interpretation of value and its social significance and the dialectical-materialist explains the objective and subjective nature of values in an integrated and complex way [1].

Some authors, such as [2], argue that there is a crisis of values where behavioural marginalism, skepticism, apathy, discrepancy and the desire for profit, double standards, formalism, hypocrisy, deceit, lack of family communication, inequity, injustice, poverty, destruction of the environment and the indigenous values of cultures, xenophobia linked to the growth of racism, by ethnic origin, culture, sexual inclination; sexual harassment, hunger, migrations, among others.

Values are not stable and eternal; they change as a result of historical-social practice and the needs of the subject; they depend to a great extent on the historical epoch; each society, class and social group in its educational conception defends and empowers the values it considers necessary to form in its citizens [3].

Values are motivational formations of human development, in which teachers have responsibility from the curricular and extracurricular activities, in the context of the professional formation of university students because of the positive social transcendence, by regulating and orienting their attitude toward humanist growth and human perfection.

There are different classifications of values, the most frequent of which refer to the content of different spheres in which theoretical-cognitive, ethical and moral, aesthetic, economic, socio-political and religious values are manifested [4].

Love for the profession, responsibility, honesty, are essential values that regulate the performance of a competent professional. Some of the recommendations given to teachers to help students make moral decisions are: listening to the experiences of the students, being a model to follow, making value judgments, motivating the reading of some books, asking good questions, helping young people to discover themselves, stimulating imagination, talking about life's subjects, stimulating commitment to society and the Fatherland and accentuating responsibility [3], in addition, for [5] one cannot think about the future if one does not know what is happening today, hence the need for this planning to arise from a diagnosis of the environment.

In the Global Monitoring Report on Education for All, the topic "The importance of having good values" was addressed, pointing out that training in values should take on a priority role such as academic training, which is why they propose training better citizens who respect the environment, the fight for peace and the training of soft skills, which is the integrated implementation of skills, personality traits, knowledge and acquired values, this requires educational programs where teachers plan, organize and manage their own teaching-learning processes, having to rely on proper training and experience, cognitive skills, knowledge, attitudes, values [5].

According to the World Declaration on Higher Education, universities have two responsibilities where they combine the ethical commitment with that of anticipating the future, creating and disseminating knowledge, since for [6] this conception of relevance implies conceiving the dynamic in the university as a space of construction of meaning and meaning among the subjects involved. The aspiration of a human and cultural institution must consider the contradictions and challenges demanded by the existence of universities tempered to their social and historical time. On the other hand, the formation of values is that integral process, where people are capable of improving and carrying out knowledge, skills, attitudes and values (know how to be) [7].

In the article "Concepciones teóricas y metodológicas para la implementación de un modelo pedagógico para la formación de valores en estudiantes universitarios" (Theoretical and methodological concepts for the implementation of a pedagogical model for the formation of values in university students), the result was aimed at determining a pedagogical model, sustained on theoretical and scientific bases, contributing from academia to the development of professional responsibility value in university students of Sciences and Engineering.

In the value responsibility as a unit of analysis of the integral formative process in students of the university of medical sciences studied by [4], it refers that the process of education in values constitutes a problem of the education of the personality, and poses a series of positive conditions that favor it, in addition to taking into account some pedagogical premises and assuming some essential didactic principles that guide this educational activity in the university praxis [8].

Some results of [9] contribute to the formation of values in university students and professors through the systematization of knowledge, criteria and reflections that serve as a general theoretical platform.

In the Ecuadorian context, the Plan for Good Living becomes a theoretical platform for working with values, which it declares "... Good Living will require that individuals, communities, peoples, and nationalities effectively enjoy their rights and exercise their responsibilities within the framework of interculturality, respect for their diversities, and harmonious coexistence with nature [10].

It is a concern of the scientific community of the University of study, reflecting on the formation of values of future university professionals. There are many aspects that reflect the urgency for students to begin the process of strengthening and applying values, so that, with them, they can improve their university coexistence and their family environment. Each human being internalizes that which satisfies his personal needs and, on this basis has interests (interests are needs made aware), forms convictions, specifies his future aspirations and comes to analyze the possibilities he has to reach them: this is how values are manifested.

The formation of values is a complex process in the development of personality, which takes place in social relations through activity and communication. When it comes to the formation of values it is necessary to assume the close relationship that exists between value, value capacity and value orientation. Thus, in the process of value formation in the Ecuadorian context, it is tempered by the profound transformations that have taken place since the Citizen's Revolution, for which reason it is necessary to develop coherent educational strategies aimed at forming a citizen in accordance with the social demands of the country [3].

According to previous studies, it was considered important to research the values and their strengthening in the students of the Regional Autonomous University of the Andes, Puyo extension, through the development of educational strategies developed in the students, from the subjects taught.

In order to measure student values, a neutrosophic model based on ideal distance is proposed, which is useful because it provides quantitative results that facilitate the ordering of the different alternatives according to the results obtained in a flexible manner. The models and theories developed in the field of neutrosophy point to the rational support for making complex decisions [11]. It is in this sense that the model is proposed in this research.

2 Methods

It is based on qualitative and quantitative approaches, combining methods, techniques and tools that facilitated the collection of data, such as: documentary analysis that allowed collecting and assessing all the knowledge of the different authors who have addressed the issue of value formation in different contexts.

The data were collected through surveys with closed-ended questions to the students, in which the formation of values was investigated, and they were analyzed quantitatively using statistics to describe the variables that characterized the population studied and to obtain a result in order to draw conclusions that would allow a correct decision making.

The interview, survey, and observations allowed the objective processing of the data that provided the information to develop educational strategies to strengthen the value system in the students of the Accounting, Auditing, and Business Administration careers through the subjects received at the Universidad Regional Autónoma de los Andes, Puyo extension.

This study was based on previous research used to support the theory, was developed based on the descriptive type, specifying properties, characteristics and important traits of the population analyzed, being useful to accurately show the angles or dimensions of the context, in addition to measure or collect information independently or jointly on the concepts and variables to which they refer.

For the development of the investigation a population conformed by 91 students of the careers of Accounting Audit and Administration of companies of the levels 1 - 9 of the presential modality was used, using a representative sample of 74 students, using the techniques of intentional sampling and random sampling, directed from the specific interests of the investigation.

Course	Number of students
Accounting and Auditing	55
Business Administration	36
Total	91

Table 1: Population distribution. Source: Own elaboration

To determine the size of the sample, an estimation of proportions was made, for a finite population, where:
n = sample size,
N = population size, in this case it is 91
z = coefficient of the confidence level with a value of 95% for which z = 1,96
p = percentage of the population that meets the characteristics of interest for the study. Assuming 50%.
q = percentage that does not meet the characteristics that is 50%.
e = working error, in this case 5%.
The formula applied to determine the sample size is the one shown through equation 1.

$$n = \frac{z^2 \cdot p \cdot q \cdot N}{e^2 \cdot (N-1) + z^2 \cdot p \cdot q} = 74 \qquad (1)$$

The result indicates that the sample selected for research was 74 students.

After the analysis that is carried out and the obtaining of results in linguistic terms, a neutrosophic model based on ideal distance is developed, which includes typical activities such as:

1. The definition of decision-making problems.
2. Problem analysis and identification of alternative solutions $X = \{x1, x2, ..., xn\}$ $(n \geq 2)$.
3. Establishment of evaluation criteria.
4. Selection of expert(s).
5. Evaluation of alternatives.
6. Sorting and selecting the best alternative.
7. Implementation and follow-up.

The model based on distance from the ideal, which is proposed in this paper has a workflow that is represented in Figure 1. Linguistic terms and indetermination through SVN numbers and based on the construction of an ideal option, is described according to the workflow of the proposed model. It should be noted that with the purpose of facilitating practical application to decision-making and engineering problems, the proposal was made for single-value neutrosophic sets [12] (SVNS) which allow the use of linguistic variables which contributes to an increase in the interpretability of recommendation models and the use of indetermination.

In this sense, and taking into account a universe of discourse, called X. A SVNS A on X is an object of the way it is mathematically described through equation 2.

A = {⟨x,uA(x),rA(x),vA(x)⟩: x ∈ X} d (2)

Where:

$uA(x)$: $X \rightarrow [0,1]$, $rA(x)$, :$X \rightarrow [0,1]$ y $vA(x)$: $X \rightarrow [0,1]$ with $0 \leq uA(x) + rA(x) + vA(x) \leq 3$ for all $x \in X$.

The intervals (x), $rA(x)$ and $vA(x)$ denote memberships to true, indeterminate and false x in A, respectively.

So an SVN number, then will be expressed as $A = (a, b, c)$, where $a, b, c \in [0,1]$ y $+ b + c + c \leq 3$.

SVN numbers have presented multiple applications in the field of Artificial Intelligence (AI). AI is one of the most strategic technologies of the 21st century. A definition of AI according to [13] is the science that seeks the deep understanding of Intelligence. The definition of this capacity, the understanding of its limits and scopes, as well as its characterization constitute a highly complex problem.

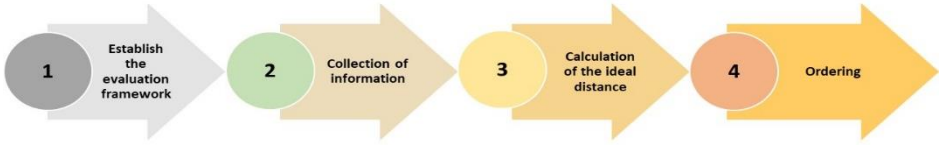

Figure 1: Workflow of the proposed model. Source: Own elaboration.

The detailed description of the workflow of the proposed model to measure the strengthening of values in Puyo University students is presented below:

1. Establish evaluation framework

The criteria and alternatives to be evaluated are selected in order to prioritize the latter. The framework is defined as follows:

C={c1,c2,...,cn} with n≥2 , a set of criteria

E={e1,e2,...,ek} with k≥1, a set of experts

X={x1,x2,...,xm} with m≥2, a finite set of alternatives

2. Collection of information

Information on the preferences of decision-makers is obtained. The utility vector (80) is represented as follows:

$Pj = \{p_{j1}, p_{j2}, \dots, p_{jk}\}$, where p_jk is the preference in relation to criterion c_k of the alternative x_j

Ratings are given using SVN numbers.

3. Calculation of the ideal distance

To evaluate the alternatives we propose to build the ideal option. The criteria can be classified as cost or benefit type. Let $C+$ be the set of criteria of type benefits and $C-$ of criteria of type cost. The ideal alternative is defined as follows:

$$I = \left\{\left(max_{i=1}^{k} T_{U_j} | j \in C^{+}, min_{i=1}^{k} T_{U_j} | j \in C^{-}\right), \left(min_{i=1}^{k} I_{U_j} | j \in C^{+}, max_{i=1}^{k} I_{U_j} | j \in C^{-}\right), \left(min_{i=1}^{k} F_{U_j} | j \in C^{+}, max_{i=1}^{k} F_{U_j} | j \in C^{-}\right)\right\} = [v_1, v_2, \dots, v_n] \quad (3)$$

4. Sort the alternatives using the Euclidean distance between single-value neutrosophic numbers (SVN), [11, 12].

Sea $A* = (A1*, A2*, ...)$ is a vector of SVN numbers such that $Aj* = (aj*, An*, cj*)$ j=(1,2, ... , n) and $Bi = (Bi1, Bi2, \dots, Bim)$ $(i = 1,2, \dots, bj*)$ or m vectors of n SVN numbers such that and $Bij = (aij, m, bij)$ $(i = 1,2, \dots, cij)$, $(j = 1,2, \dots, n)$ then the Euclidean distance is defined as. The Bi and $A*$ is [21]:

$$s_i = \left(\frac{1}{3}\sum_{j=1}^{n}\left\{\left(|a_{ij} - a_j^*|\right)^2 + \left(|b_{ij} - b_j^*|\right)^2 + \left(|c_{ij} - c_j^*|\right)^2\right\}\right)^{\frac{1}{2}} \quad (4)$$

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

The sorting is carried out from lowest to highest from the overall distance value obtained. The closer the alternative of Ai is to the ideal point (si minor), the better it will be, allowing an order to be established between alternatives.

3 Results

With the results of the survey applied to the students object of study in the courses of Accounting and Auditing and Business Administration of the Regional Autonomous University of the Andes, Puyo extension, the statistical analysis was carried out, based on the descriptive ordering of absolute frequencies, proportions and percentages by category, of the variables and indicators of the same. In this way, table 2 shows the results derived from the

opinion issued by the74 students chosen in the sample, where, in the ethic-moral indicator, 50% know that ethics is related to moral values and 30% consider that it is almost always related to morals and behavior, 20% express that sometimes these relationships are fulfilled. 100% said that there is always mutual respect between teachers and students and that there is a kind and courteous treatment; considering respect as the essence of human relations, of community life, of teamwork, of conjugal life, of any interpersonal relationship.

Regarding the responsibility indicator, they recognize that this indicator allows them to reflect, administer, guide, and assess the consequences of their actions. 68% admitted that they almost always assume the consequences of the actions of their academic performance in compliance with the duties assigned by the teacher, 20% always comply, and 12% sometimes comply.

As for the solidarity indicator, 64% admitted that they always exercise mutual support among their peers, especially in compromised or difficult situations (academic insufficiency, family problems, among others). 34% think they do it almost always; 2% almost never.

On the other hand, in the indicator friendship, 54% stated that a harmonious atmosphere is always maintained in class spaces, promoting union among classmates, 26% almost always; 15% raised sometimes.

In the Tolerance indicator, 50% state that they always have the capacity to listen and accept others, valuing the different ways of understanding and positioning themselves in the way of acting, 34% almost always and 16% sometimes.

The indicator Cooperation, 61% answered that they work together giving mutual help in an organized way for the promotion of common ends in this way the success of one depends on the success of the others, 20% almost always and 20% sometimes.

Indicators	*Always*		*Almost always*		*Sometimes*		*Almost never*		*Never*	
	FA	FR %	FA	FR %	FA	FR %	FA	FR%	FA	FR%
Ethics - Moral	37	50	22	30	15	20	0	0	0	0
Respect	74	100	0	0	0	0	0	0	0	0
Liability	15	20	50	68	9	12	0	0	0	0
Solidarity	47	64	25	34	0	0	2	2	0	0
Friendship	40	54	19	26	15	20	0	0	0	0
Tolerance	37	50	25	34	12	16	0	0	0	0
Cooperation	45	61%	15	20%	14	19%	0	0%	0	0%

Table 2: Formation of values in the students of the careers of Accounting and Auditing and Business Administration. Source: Diagnosis

The overall results of the current state of the values of the students in the sample studied reflect that despite maintaining important values ingrained, it is necessary to strengthen them for social and professional development.

The proposal of educational strategies to strengthen the system of values in the students through the subjects received in the careers of the Regional Autonomous University of the Andes, Puyo extension, was based on the following actions:

1. Elaboration of didactic guides based on problematic situations that demand reflection and analysis in the students.
2. Workshop on the formation of values that facilitate the assimilation of attitudes and values, such as: respect, solidarity, collaboration, among others.
3. Debates on the value system.
4. Group dynamics.
5. Develop interpersonal communication.
6. To deepen the feeling of national identity.
7. To raise the professional quality in the solution of the country's problems.
8. Encourage the participation of students to debate opinions and ideas on the different aspects of learning (the relevance or not of learning a certain content, objectives, customs, use of common spaces, evaluations).
9. Facilitate through the learning of the subjects of certain important attitudes, such as cooperation, solidarity, equity, fraternity, taking into account the human and professional values of each of the careers.
10. Promote the development of values in each of the students or from the empowerment of the development of self-esteem, self-valuation and self-education from the knowledge of the possibilities of personal fulfillment and the real conditions to materialize them.

Based on the characteristics of the proposal of educational strategies to strengthen the value system, the neutrosophic model based on the ideal distance is developed in the students of Puyo University. According to the workflow of the proposed model, represented in figure 1, one has to:

The establishment of the evaluation framework according to the domain in which the information is verbalized, is in linguistic terms which are shown in table 1.

Linguistic Term	SVN Numbers
Extremely good (EG)	(1,0,0)
Very very good (VVG)	(0.9, 0.1, 0.1)
Very good (VG)	(0.8,0,15,0.20)
Good(G)	(0.70,0.25,0.30)
Medium good (MDG)	(0.60,0.35,0.40)
Medium(M)	(0.50,0.50,0.50)
Medium Bad (MDB)	(0.40,0.65,0.60)
Bad (B)	(0.30,0.75,0.70)
Very bad (VB)	(0.20,0.85,0.80)
Very very bad (VVB)	(0.10,0.90,0.90)
Extremely bad (EB)	(0,1,1)

Table 3: Linguistic terms used [21].

Once the terms in which the information is verbalized are defined, we proceed with the evaluation of the three fundamental actions to be taken into account for the development of educational strategies, in order to strengthen the system of values in the students of the Universidad Regional Autónoma de los Andes, Puyo extension.

$c1$: Factors are analyzed, identified and defined for the development of proposed educational strategies to strengthen the value system in students.

$c2$: Factors for the development of educational strategy proposals are put into practice.

$c3$: The actions to be developed to elaborate the proposal of educational strategies to strengthen the system of values in the students are planned.

Once the prioritization framework is established, the information is obtained.

	$x1$	$x2$	$x3$
$c1$	MDG	B	VVG
$c2$	G	VVG	G
$c3$	G	MDG	VG

Table 4: Preferences obtained. Source Own preparation.

From the obtained information (table 2) the ideal alternative is selected which resulted:

$$E+= (VVG, VVG, VG)$$

The results of the calculation of the distances, allows sorting the actions to develop according to the development of educational strategies. For our case study is obtained in order of priority, $x3 \succ x1 \succ x2$. This means that when debates on the value system are carried out, it is possible to elaborate didactic guides based on problematic situations that demand reflection and analysis in the students, to implement it through workshops on the formation of values that facilitate the assimilation of attitudes and values such as: respect, solidarity, collaboration, among others.

On the other hand, it should be noted that the formation of values begins at an early age where the individual becomes part of a culture, internalizing it, respecting its rules and procedures. It is a process that begins in the family, becoming the first space of socialization where we learn to live in collectivity and build our cultural identity, renewing every day our affections, ways of thinking and action, playing a decisive role in the development of personality and societies, for which it lasts a lifetim[14].

The results obtained demonstrate that the formation of values is a process that is developed in the personality of the individual, in his social and cultural life, which must be systematic not only in the acquisition of knowledge but in the determination of interpersonal behavior that expresses individual or collective interests and their education must be continuous and permanent with the responsibility of each and every one of the members of the educational community that helps the integral formation of the student.

It is also noted that education in values has to be a systematic task that must be welcomed with responsibility, starting from the integral formation of the person, who needs the acquisition of scientific knowledge, and the

learning of cultural patterns that contribute to be useful. Educating in values means helping people to construct their own scale of values in a reasoned and autonomous way, so that they are capable of making moral decisions in conflictive moments of their lives, helping people to relate effectively, achieving coherence between their thoughts and values with their actions.

On the other hand, it stands out that an adequate formation of values is not achieved but we are examples of transmission of the same ones with our daily act, not only in the classrooms, but also with our general behavior in our society, acting in consequence with the historical moment. In order to develop our values, it is important to have a critical thought where the capacities of creativity and logic are strengthened, which allows us to process new strategies in the ways of seeing and perceiving things, analyzing, understanding and interpreting the world in which we live.

After the theoretical analysis and the results of procedures and techniques applied to the sample under study, it was corroborated that analogous topics have been addressed in other institutional contexts. These studies have had their contribution to the analysis of the formation of values, being a necessary element in any of the stages of its formation in the university, as well as the subjects that conform the academic programs, we consider that it is a subject in which we have to particularize according to the radius of action that we find ourselves.

The analyzed values have great importance for the development of the personality, they represent modes of behavior in general that must govern in the conduct and determine consequently their attitudes and their way of acting.

The application of strategies in a systematic manner allows reflection, the assimilation of attitudes, fostering companionship, promoting the strengthening of the development of self-esteem, self-esteem and self-education, to achieve the values that we must promote with greater acuity such as ethics, morals, responsibility, respect, solidarity, friendship, tolerance, cooperation, the spirit of sacrifice and justice [14].

Conclusion

The education of values in higher education is a subject of great topicality and importance in the training of professionals needed by society. Values are beliefs, principles founded on man for his social action, is a pattern of behavior before the action of selecting a certain situation, be it positive or negative, therefore, it comes to make its axiological model that leads to motivation and satisfaction to the full, providing a guideline that guides the formulation of personal or collective goals or purposes.

The proposed educational strategies will contribute to strengthening the integral formation of students, offering from their learning axiological sources such as friendship, moral ethics, generosity, solidarity, honesty, responsibility, respect, tolerance and cooperation taking into account the human and professional values of each of the careers.

The development of the neutrosophic model based on ideal distance to measure the strengthening of the values in the students of the Puyo University contributed to determine the actions to take into account for the development of educational strategies.

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Received: January 10, 2019. Accepted: May 16, 2019

Pestel analysis based on neutrosophic cognitive maps and neutrosophic numbers for the sinos river basin management

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Abstract. The Sinos River watershed is one of the most polluted water basins in Brazil with great efforts for its recovery through integral management. PESTEL is an analysis for the study of the external variables with influence in the efficiency of the organization or project. This paper presents a model to address problems encountered in the measurement and evaluation process of PESTEL analysis taking into account interdependencies among sub-factors and modeling uncertainty and indeterminacy in Sinos river basin. A Neutrosophic Cognitive Maps was used for modeling the integrated structure of PESTEL sub-factors. A quantitative analysis was developed based on static analysis and neutrosophic numbers. To demonstrate the applicability of the proposal in the Sinos river external factor analysis a case study is developed. Interdependencies among sub-factors were includes and uncertainty and indeterminacy were modeled in a practical way. Sub-factor was ranked and reduced, with Ecological, Technological and Social are the top three factors. The paper ends with a conclusion and future work recommendations.

Keywords: Sinos River Basin; PESTEL; Neutrosophy; Neutrosophic Cognitive Maps; Static Analysis

1 Introduction

PEST is an analysis for the study of the external variables with influence in the efficiency of the organization or project. These variables involved in the business environment are grouped in Political, Economical, Social, and Technological aspects [1].

The conceptual structure and nature of PEST require an integrated approach for considering importance and interrelation. The standard technical framework of the PEST approach mainly provides a general idea about macro conditions and the situation of an organization, so it is inadequate. Therefore, PEST analysis lacks a quantitative approach to the measurement of the interrelation between its factors. When the environment and legal factors are included, it is named PESTEL (Political, Economic, Socio-cultural, Technological, Environment, and Legal) analysis [2]. Political variables refer to the regulatory aspects that directly affect the enterprise. Here enter the taxes rules or business incentives in specific sectors, regulations on employment, the promotion of foreign trade, government stability, the system of government, international treaties or the existence of internal conflicts or with other current or future countries — also the way in which the different local, regional and national administrations are organized [3]. Economic variables relate to macroeconomic data, Gross domestic product (GDP) evolution, interest rates, inflation, unemployment rate, income level, exchange rates, access to resources, level of development, economic cycles. Current and future economic scenarios and economic policies should also be investigated.

Social variables take into account are demographic evolution, social mobility and changes in lifestyle — also the educational level and other cultural patterns, religion, beliefs, gender roles, tastes, fashions and consumption habits of society. In short, the social trends that may affect the enterprise business [3]. Technological variables are somewhat more complicated to analyze due to the high speed of the changes in this area. It is necessary to know the public investment in research and the promotion of technological development, the technology diffusion, the degree of obsolescence, the level

of coverage, the digital device, the funds destined to R & D + I, as well as the trends in the use of new technologies. Ecological variables are the main factors to be analyzed aware of the conservation of the environment, environmental legislation, climate change, and temperature variations, natural risks, recycling levels, energy regulation and possible regulatory changes in this area[4]. Legal variables refer to legislation that is directly associated with the organization functions, information on licenses, labor legislation, intellectual property, health laws, and regulated sectors[5].

PESTEL analysis has deficiencies for a quantitative approach to the measurement of interrelation among factors are generally ignored [6]. Fuzzy cognitive maps (FCM) is a tool for modeling and analyzing interrelations [7]. Connections in FCMs are just numeric ones: the relationship of two events should be linear.

The Neutrosophy can operate with indeterminate and inconsistent information, while fuzzy sets and intuitionistic fuzzy sets do not describe them appropriately [4]. Neutrosophic cognitive maps (NCM) is an extension of FCM where was included the concept indeterminacy [8]. The concept of fuzzy cognitive maps fails to deal with the indeterminate relation [1].

In this paper, a PESTEL analysis based on neutrosophic cognitive maps is presented proposal methodological support and make possible of dealing with interdependence, feedback, and indeterminacy. Additionally, the new approach makes conceivable to category and to reduce factors.

This paper continues as follows: Section 2 reviews some essential concepts about the PESTEL analysis framework, NCM, and fuzzy numbers. In Section 3, a framework for the PESTEL shows a static analysis based on NCM. Section 4, displays a case study of the proposed model applied to social-environmental management of a river basin. The paper finishes with conclusions and additional work recommendations.

2. Case Study

The Sinos River Basin is one of the most contaminated water basins in Brazil [9] which leads to great efforts for its recovery through integral management. Due to the complex nature of the interrelations between the different factors involved in environmental quality management becomes intricate and therefore requires the use of tools that facilitate decision making[10]. Through a participatory exercise with stakeholder members of the COMITESINOS, external variables were identified and a diffuse cognitive map was constructed representing the relationships among the variables. This process of identifying PESTEL variables was carried out with the members of the committee, for which work sessions were held in the coordination meetings. To elaborate on the NCM, Mental Modeler tool of the website http://www.mentalmodeler.org/ was used.

Initially, factors and sub-factors were identified for Sinos river basin management as follows:

I. Relevant Political-Legal Aspects
In the political dimension, the following variables were identified:
1. Influence of the federal government in the watersheds management (N1)
2. Importance of the state government in the management of the basin (N2)
3. Control of the municipal government in the watershed management (N3)
4. Impact of bureaucracy on management (N4)
5. Corruption impact (N5)

II. Relevant economic and socio-economic aspects
In the socioeconomic dimension, the following variables were identified:
1. Poverty (N6)
2. Per capita income(N7)
3. Quality of solid waste collecting services (N8)
4. Quality liquid waste service (N9)
5. Water supply service (N10)
6. The quality of public health (N11)
7. Quality of sewage and sewage services (N12)

III. Relevant social aspects
In the social dimension, the variables identified were:
1. Public education (N13)
2. Population access to food (N14)
3. Access to the housing (N15)

IV. Relevant sociocultural aspects

In the sociocultural dimension, the variables identified were:
1. Perception of the environmental relevance in the local culture (N16)
2. Knowledge of environmental risk (N17)
3. Understanding of environmental awareness (N18)

V. Relevant technological aspects
The variables identified in the technical dimension were:
1. Innovation(N19)
2. Cleaner production(N20)
3. Eco-efficiency (N21)

For the ecological dimension was possible to identify the following variables:
1. Water quality index (WQI)(N22)
2. Air Quality index (AQI) (N23)
3. Landscape change and urban planning(N24)
4. Variations in the biodiversity index of ecosystems value (N25)
5. Climate Change (N31)
6. Soil Quality index (N32)

Legal dimension includes the following factors
1. Environmental Laws (N26)
2. Education regulation (27)
3. Health regulations (28
4. Environmental law (29)
5. Employment Laws (N30)
6. Consumer Law (33)

Interdependencies are identified and modeled using an NCM (Figure 1), with whose weighs represented in Table 1.

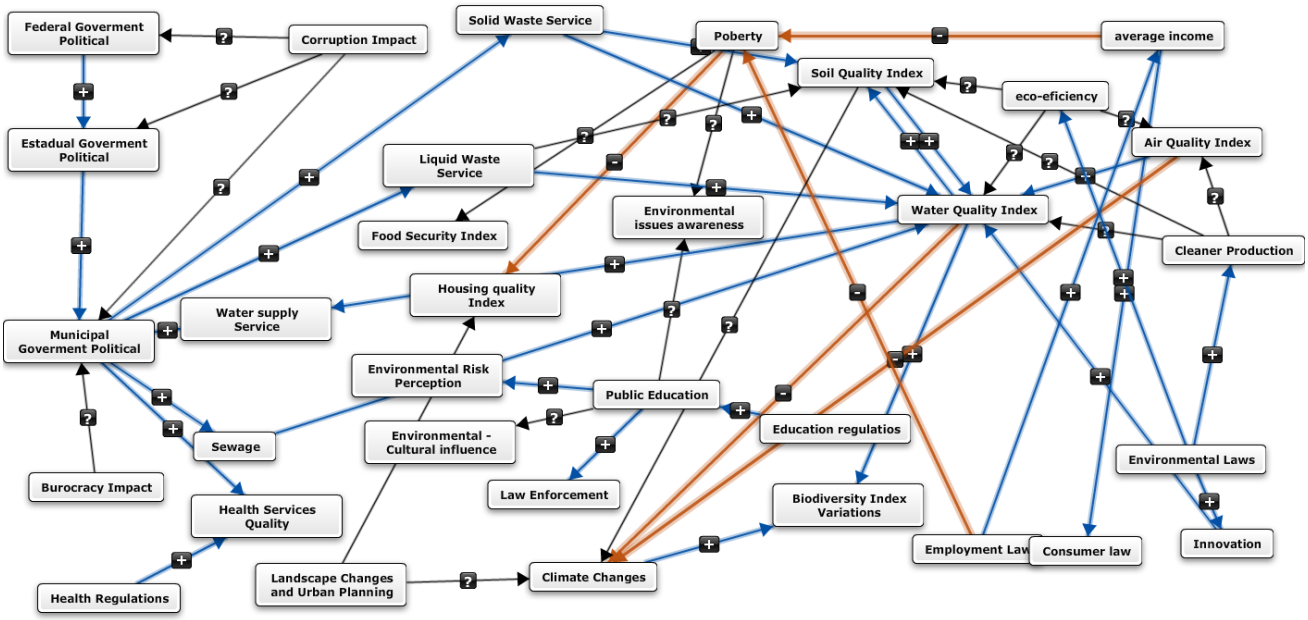

Figure 1: Fuzzy Neutrosophic Cognitive Maps of PESTEL factors.

2 Materials and Methods

2.1 Preliminaries

This article offers a first brief review by PESTEL analysis and the factors' interdependency. The following is a review of the basic concepts of NCM.

2.1.1 PESTEL Analysis

The PESTEL method is a prerequisite analysis with a network function to identify the characteristics of the environment in which an organization or project operates, provides data and information so that the organization can make predictions about new situations and circumstances and act accordingly. [12, 13]. The variables analyzed in PESTEL are identified and evaluated independently. [2] not taking into account interdependency. In [14] this approach based on fuzzy decision maps is presented taking into account the ambiguity, the uncertainty in their interrelationships.

This study presents a model to address the problems encountered in the PEST measurement and evaluation process, taking into account the interdependencies between the subfactors. NCM modeled the integrated structure of the PESTEL subfactor, and the quantitative analysis is developed from a static analysis that allows to classify and reduce the factors in line with the proposals presented in [15].

2.1.2 Neutrosophic Cognitive Maps.

The Neutrosophic Logic (NL) like a generalization of the fuzzy logic was introduced in 1995 [16]. According to this theory, a logical proposition P is characterized by three components:

NL (P) =(T,I,F) (1)

Where the neutrosophic component T is the degree of truth, F the degree of falsehood, and I is the degree of indeterminacy [7]. Neutrosophic set (NS) was introduced by F. Smarandache who introduced the degree of indeterminacy (i) as an independent component[11] .

A neutrosophic matrix content where the elements are a = (a_{ij}) have been replaced by elements in ⟨R∪I⟩. A neutrosophic graphic has at least one edge is a neutrosophic edge . If the indetermination is found in the cognitive map, it is called the neutrosophic cognitive map (NCM) [20]. NCM is based on neutrosophic logic to represent uncertainty and indeterminacy in cognitive maps [12]. An NCM is a directed graph in which at least one edge is an indeterminate border and is indicated by dashed lines [2] (Figure 2).

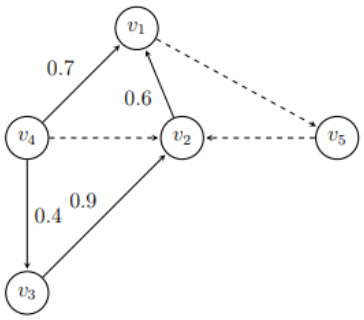

Figure 2: Fuzzy Neutrosophic Cognitive Maps example.

In [9] a static analysis of an NCM is presented.

2.1.3 Neutrosophic numbers

The result of the static analysis is in the form of neutrosophic numbers (a+bI, where I = indeterminacy) A de-neutrosification process as proposed by Salmeron and Smarandache could be applied giving final ranking value [13].

A neutrosophic number is a number as follows [14] :

N=d+I (2)

Where d is the determinacy part, and i is the indeterminate part. For example s: a=5 +I si i∈ [5,5.4] is equivalent to a∈[5,5.4].

Let $N_1=a_1+b_1$ I and $N_2=a_2+b_2$ I be two neutrosophic numbers then the following operational relation of neutrosophic numbers are defined as follows [8]:

$N_1+ N_2=a_1+a1+(b_1+b_2)$ I;

$N_1- N_2=a_1-a_1+(b_1-b_2)$ I

2.2 Proposed Framework

The aim was to develop and further detail a framework based on PESTEL and NCM [25]. The model was made in five steps (graphically, figure 3).

Figure 3: The proposed framework for PESTEL analysis [25]

2.2.1 Factors and sub-factors identification in the PESTEL method

In this step, the significant PESTEL factors and sub-factors were recognized. Identify factors and subfactors to form a hierarchical structure of the PESTEL model. Sub-factors are categorized according to the literature [2].

2.2.2 Modeling interdependencies

In this step causal interdependencies between PESTEL sub-factors are modeled, consists in the construction of NCM subfactors following the point views of an expert or expert team.

When a selection of experts (k) participates, the adjacency matrix of the collective MCD is calculated as follows:

$E=\mu(E_1,E_2,\ldots,E_k)$ (3)

The operator is usually the arithmetic mean [13].

2.2.3 Calculate centrality measures

Centrality measures are calculated [7] with absolute values of the NCM adjacency matrix [15]:

1. Outdegree $od(v_i)$ is the summation of the row of absolute values of a variable in the neutrosophic adjacency matrix, and It shows the cumulative strengths of connections (c_{ij}) exiting the variable.

$$od(v_i) = \sum_{i=1}^{N} c_{ij} \quad (4)$$

2. Indegree id(v_i) is the summation of the column of absolute values of a variable, and it shows the cumulative strength of variables come in the variable.

$$id(v_i) = \sum_{i=1}^{N} c_{ji} \quad (5)$$

3. The centrality degree (total degree $td(v_i)$), of a variable is the sum of its indegree and outdegree

$$td(v_i) = od(v_i) + id(v_i) \quad (6)$$

2.2.4 Factors classification and ranking

The factors were categorized according to the next rules:

The variables are a Transmitter (T) when having a positive or indeterminacy outdegree, $od(v_i)$ and zero indegree, $id(v_i)$.

The variables give a Receiver (R) when having a positive indegree or indeterminacy, $id(v_i)$., and zero outdegree, $od(v_i)$.

Variables receive the Ordinary (O) name when they have a non-zero degree, and these Ordinary variables can be considered more or less as receiving variables or transmitting variables, depending on the relation of their indegrees and outdegrees.

The de-neutrosophication process provides a range of numbers for centrality using as a ground the maximum & minimum values of I. A neutrosophic value is switched in an interval with these two values. $\in[0,1]$.

The contribution of a variable in an NCM can be known by calculating its degree of centrality, which shows how the variable is connected to other variables and what is the accumulated force of these connections. The median of the extreme values as proposed by Merigo [29] is used to give a centrality value :

$$\lambda([a_1, a_2]) = \frac{a_1 + a_2}{2} \quad (7)$$

Then

$$A > B \Leftrightarrow \frac{a_1 + a_2}{2} > \frac{b_1 + b_2}{2} \quad (8)$$

Finally, a ranking of variables could be given.

2.2.5 Factor prioritization

The numerical value obtained in the previous step is used for sub-factor prioritization and/or reduction. Threshold values may be set to 1.5 % of the total sum of total degree measures for subfactor reduction. Additionally, sub-factor could be grouped by parent factor and to extend the analysis to political, economic, social and technological general factor.

3 Results and Discussion

Case of study result.

0	0.28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0.28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0.39	0.33	0.25	0.28	0.25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	i	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	i	i	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	i	-0.67	0	0	i	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	-0.58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.36
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.31	0	0	0	0	0	0	0	0	0	0.33	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.39	0	0	0	0	0	0	0	0	0	i	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.25	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.28	i	i	0	0	0	0	0	0	0	0.42	0	0	0	i	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.33	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	i	i	0	0	0	0	0	0	0	0	i	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	i	i	0	0	0	0	0	0	0	0	i	0
0	0	0	0	0	0	0	0	0	0.25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.36	0	0	0	0	0	-0.53	0.42	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.28	0	0	0	0	0	0	0	0	-0.5	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	i	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	i	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0.47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0.36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.42	0.36	0.47	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	-0.58	0.42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.28	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.31	0	0	0	0	0	0	0	0	i	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Tabla 1: Neutrosophic Adjacency Matrix

Nodes are initially classified (Table 2)

N1	T	N10	R	N19	O	N28	T
N2	O	N11	R	N20	O	N29	T
N3	O	N12	O	N21	O	N30	T
N4	T	N13	O	N22	O	N31	O
N5	T	N14	R	N23	O	N32	O
N6	O	N15	R	N24	O	N33	R
N7	O	N16	R	N25	R		
N8	O	N17	R	N26	R		
N9	O	N18	R	N27	T		

Tabla 2: Nodes classification

Total degree (Eq. 5) was calculated. Results are shown in Table 3.

N1	0,28	N9	0.72+i	N17	i	N25	0.64	N33	0.36
N2	0.56+i	N10	0.5	N18	2i	N26	0.42		
N3	1.78+2i	N11	0.64	N19	0.75	N27	0.47		
N4	I	N12	0.5	N20	0.36+3i	N28	0.36		
N5	2i	N13	1.17+3i	N21	0.47 + 3i	N29	1.25		
N6	1.83+2i	N14	i	N22	2.37+2i	N30	1+i		
N7	1.36	N15	0.67+i	N23	0.78+2i	N31	1.31+2i		
N8	1.03	N16	0.28	N24	2i	N32	1.06+4i		

Tabla 3: Total degree

"The next step is the de-neutrosophication process as proposes by Salmeron and Smarandache. I ∈[0,1] is replaced by both maximum and minimum values" [33]. In Table 4 are presented as interval values.

N1	0,28	N9	[0.72, 1.72]	N17	[0,1]	N25	0.64	N33	0.36
N2	[0.56, 1.56]	N10	0.5	N18	[0,2]	N26	0.42		
N3	[1.78, 2.78]	N11	0.64	N19	0.75	N27	0.47		
N4	[0,1]	N12	0.5	N20	[0.36, 3,36]	N28	0.36		
N5	[0, 2]	N13	[1.17, 4.17]	N21	[0.47, 3.47]	N29	1.25		
N6	[1.83,3.83]	N14	[0,1]	N22	[2.37, 4.37]	N30	[1, 2]		
N7	1.36	N15	[0.67, 1.67]	N23	[0.78, 2.78]	N31	[1.31, 3.31]		
N8	1.03	N16	0.28	N24	[0, 2]	N32	[1.06, 5.06]		

Tabla 4: De-neutrosophication, total degree values

Finally, we work with the median of the extreme values (Table 5) [29].

N1	0.28	N9	1.22	N17	0.5	N25	0.64	N33	0.36
N2	1.06	N10	0.5	N18	1	N26	0.42		
N3	2.28	N11	0.64	N19	0.75	N27	0.47		
N4	0.5	N12	0.5	N20	1.86	N28	0.36		
N5	1	N13	2.67	N21	1.97	N29	1.25		
N6	2.83	N14	0.5	N22	3.37	N30	1.5		
N7	1.36	N15	1.17	N23	1.75	N31	2.31		
N8	1.03	N16	0.28	N24	1	N32	3.06		

Tabla 5: Total degree using the median of the extreme values

Top 6 nodes according to centrality are represented in table 6.

N22	3,37
N32	3,06
N6	2,83
N13	2,67
N31	2,31
N3	2,28

Tabla 6: Top 6 nodes

Water quality index, Soil Quality index and Poverty are the top three factors. Centrality measures of subfactor were grouped according to their parent factors (Figure 4).

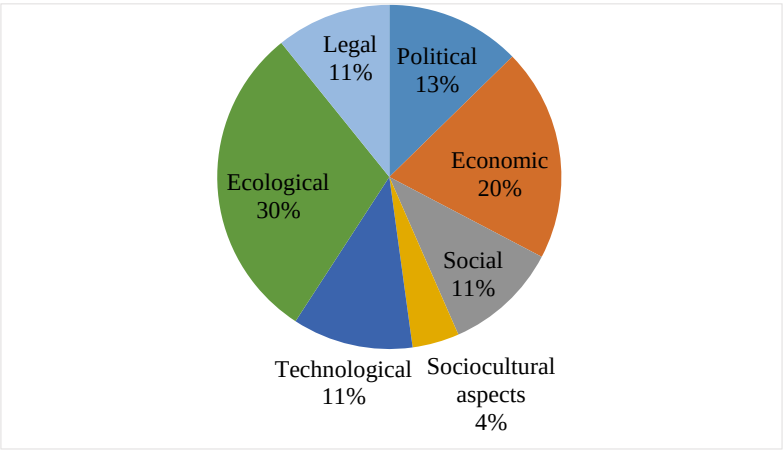

Figure 4: Aggregated total centrality values by factors

When the average is used as aggregation´s operator, the result is represented in Figure 5. Ecological, Technological and Social are the top three factors.

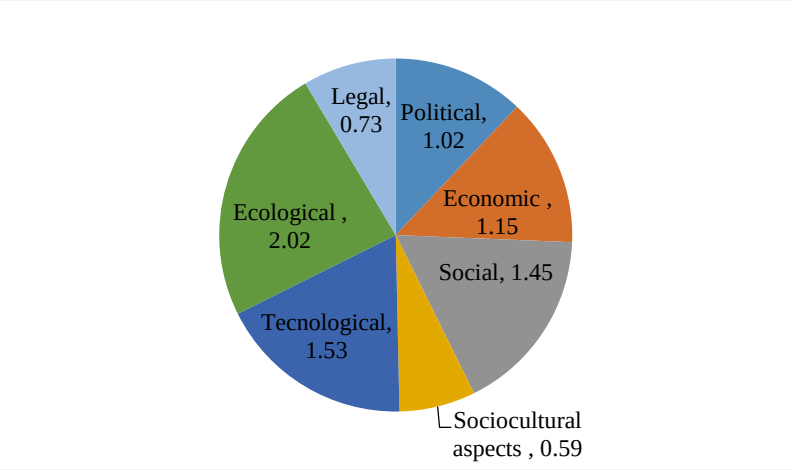

Figure 5: Average of total centrality values by factors

Factors with a little incidence of less than 1.5 % (0.606) are reduced for further analysis. In this case, we found nodes like N1, N4, N10, N14, N16, N17, N26, N27, N28 and N33.

After the application, in this case, study the model was found practical to use. The NCM gives high flexibility and takes into account interdependencies PESTEL analysis.

Conclusion

This study presents a model to address problems encountered in the measurement evaluation process of PESTEL analysis taking into account interdependencies among sub-factors and modeling uncertainty and indeterminacy in Sinos river basin. NCM modeled the integrated structure of PESTEL sub-factors, and quantitative analysis was developed based on static analysis and neutrosophic numbers.

To demonstrate the applicability of the proposal in the Sinos river external factor analysis a case study is developed. Sub-factor was ranked and reduced with Ecological, Technological, Social are the top three factors.

NCM modeled the integrated structure of PESTEL of factors and sub-factors. Our approach has many applications in complex decision problem that include interdependencies among criteria, and such as complex strategic decision support in river basin management.

Further works will concentrate on extending the model for dealing scenario analysis in conjunction with a multicriteria environment. Another area of future work is the development of a software tool.

Conflicts of Interest

No conflict of interest are declared by the authors.

Funding Statement

This study was partially supported by "Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brasil (CAPES)" -Finance Code 001.

Data Availability Statement

The data used to support the findings of this study are included within the article.

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Received: January 11, 2019. Accepted: May 17, 2019

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Prospective analysis of public management scenarios modeled by the Fuzzy Delphi method

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Abstract. In the Latin American region, public management systems are driven almost exclusively by a formal mechanism. This is a difficulty when implementing study methodologies that provide objective data for the analysis and evaluation of the effectiveness, relevance and sustainability of the policies established by the states governments. Given that the political-social contexts of each nation determine a series of subjective and imprecise factors, and that the main officials and social actors that rule the development of strategic plans regarding public services are inscribed within a certain reality for internal and external incidents; a neutrosophic analysis of the fuzzy, gray and / or undefined zones of the relations between the political system and the administrative system becomes evident. Neutrosophy, as a discipline that studies undefined areas between opposing ideas or sentences, offers a theoretical framework suitable for the analysis of the previously described problematic. This article summarizes a prospective analysis of public management scenarios, developed through the Fuzzy Delphi method, in order to detect the main difficulties faced by current public management mechanisms and propose solutions accordingly. For this, it relies on a survey conducted in Argentina to officials of the Administration sector. A fuzzy approach to improve public management, methodological applications even case. Buenos Aires: University of Buenos Aires. School of Economics.

Keywords: Neutrosophy, Fuzzy Delphi method, neutrosophic analysis, public management, prospective analysis, Government Administration**.**

1 Introduction

The strategies that model public management [1], arise from the interaction between the political system and the administrative system of the states. It is in this interaction where spaces of power are produced with gray areas, which determine the success or failure of the set objectives. It is necessary, therefore, to study the way in which the processes of identification, elaboration, implementation and evaluation are modeling the social management within the political systems.

In Latin America, the public management[2] model is strictly formal, giving way to limitations in the control of the use of real and economic resources of nations. The lack of analysis in the previously defined areas of power, suppresses, in most cases, the obligation to be accountable for the objective results that are achieved and compare them with those that each government assumes to offer.

On this basis, the following issues can be defined as elements that make the optimal performance of public management impossible:

- Poor research, which leads to a lack of transparency in the role of the State.
- Inadequate management of the budget by Congress, which instead of managing their assets as a producer and provider of social services, is centered on approving the requested expenses.
- Centralization, both in the regulations, and in its implementation
- Lack of motivation of public administrators and little or no recognition of efficiency in social management.
- Theoretical approaches that are not able to be corroborated in practice, as a consequence of a legal and juridical system that proposes objective changes, based on a conceptual basis.

The previous difficulties give way to a methodology that is separated from the daily practice. Consequently, an analysis, that proposes new solutions for the social claim of adapting the management model of public organizations, it's needed. It is crucial to establish follow-up and evaluation actions that lead to transparency and viability of public programs and resources, adopting flexible and renovating positions.

The present investigation shows a prospective analysis of the scenarios from which public management is articulated, in order to propose viable solutions for its implementation in the Latin American context, taking as a sample the Argentine society and as a fundamental basis the most recent studies in the field of Neutrosophy[3] .

The models related to the economic State policies and the microeconomic decisions of the companies offer a simplified representation of reality. They do not reveal in detail the economic and social complexities, because they are unlimited.

Neutrosophy proposes an analysis of neutralities [2], taking into account the spectrum of neutralities <Neut-A> between an idea or notion <A> and its opposite or negation <Anti-A>.

The sentences <Neut-A> and <Anti-A> are considered <Non-A> and each idea or notion <A> must be balanced or "neutralized" by the ideas or notions <Anti-A> and <Non-A >

Given that the analysis relevant to the present investigation presents vague or imprecise edges, the consensus between <A>, <Neut-A>, <Anti-A> and <Non-A> is analyzed, through a study supported by the fuzzy model [4].

Finding a balance between the political system and the administrative system requires a search within undefined spaces, which is why the Fuzzy model is appropriate for capturing gray areas .

Analyzing from the neutrosophic logic, where each sentence has three dimensions that are represented by a truth space (T), a falsehood space (F) and an indeterminate space (I), the ideas or approaches between 0 and 1, being 1 Positive or Truth (T) and 0 Negative or False (F).

To establish and analyze the statistics, the neutrosophic probability (NP) [4] is used, where a variable, randomly (x) is distributed in the following way: NP (x) = (T (x), I (x), F (x))

Taking as a starting point the considered primitive terms: set, element-of and element, you can define inclusion and equality. To name sets, uppercase letters will be used, while different elements will be designated with lowercase letters. The "*element-of"* of an element in a set will be indicated with ∈; so that if x is an element of A, then x ∈ A.

If a set A is included in another set E, then all elements of set A are included in element E and symbolized A ⊆ E, and E is the universal or referential set.

The number of elements that make up an E set is its cardinal[5]. If E is finite of n elements, then #E = n

For every element x that belongs to the set E, the basic function would be[6]:

$$\mu A: E \rightarrow \{0,1\} / \mu A(x) = \begin{cases} 1\ x \in A \\ 0\ x \notin A \end{cases} \quad (1)$$

According to the above, $\mu_A(x) = 1$ indicates that $x \in A$ and $\mu_A(x) = 0$ indicates that $x \notin A$.

μ_A is the ∈ of x to set A. It is called an empty set, and symbolizes ∅, to the sharp set where $\mu\emptyset(x) = 0$.

Basic operations between sets (with A and B subsets of E) :

Union of A and B:

$A \cup B = \{x / x \in A \vee x \in B\}$ "∨": o

Intersection of A and B:

$A \cap B = \{x / x \in A \wedge x \in B\}$ "∧": y

Complement of A, formed by elements included in the referential, but not belonging to A:

$\bar{A} = \{x \in E / x \notin A\}$

Summarizing; if $x \in A$, then $x \notin \bar{A}$, and vice versa, if $x \notin A$ then, $x \in \bar{A}$; so that $\mu_A(x) = 1$, only if, $\mu_{\bar{A}}(x) = 0$.

In addition, in the Union set, the value of the ∈ function will be the largest of the elements that correspond in each set, that is, the greater between $\mu_A(x)$ and $\mu_B(x)$.

On the contrary, in the Intersection set, the value of the ∈ function will be the smallest of the corresponding elements in each set, that is, the lowest between $\mu_A(x)$ and $\mu_B(x)$.

In correspondence with the above definitions, the operations specified for the clear sets can be represented symbolically through the characteristic function (valid for any set A, B and C included in a reference E)

$\mu_{A \cup B}(x) = \max \{\mu_A(x), \mu_B(x)\}$

$\mu_{A \cap B}(x) = \min \{\mu_A(x), \mu_B(x)\}$

$\mu_{\bar{A}}(x) = 1 - \mu_A(x)$

2 Material and methods

Given the implicit need to manage the data compiled prospectively, touching the gray areas where the interaction of the political instrument with the administrative one converge and derive in much more relative information, it has been decided to use the Fuzzy - Delphi method [5,6].

This methodology allows us to analyze complex problems outside the Aristotelian logic of positive and negative. In this way, it is possible to establish a system of statistics on arguments that are included within the <Neut-A> and at the same time structured on the basis of a predictive procedure.

To the basic functions characteristic for sets A, B and C, which are included in a reference E, an analysis based on fuzzy subsets will be applied. In this way, the intervals between "∈" and "∉" will be analyzed; "true and false". The basic function will be generalized to take any real value included in the interval [0, 1].

According to the above, in a universe or referential E, a fuzzy set, represented symbolically by Ã, is a function $\mu_{\tilde{A}}$: E ⇾ [0, 1]. Therefore, it assigns to each element of the set E a value $\mu_{\tilde{A}}(x)$ belonging to the interval [0, 1] a degree or level of ∈ from x to Ã.

The symbol ∼ will be adopted to indicate a fuzzy set. The support of a fuzzy subset Ã of E is the sharp set that contains all the elements of the reference E whose membership function is non-zero: S (Ã) = {x ∈ E / μ_A (x)> 0}

If E is infinite, the fuzzy subset is expressed by its ∈ function.

The fuzzy subsets Ã and B of the same referential E are equal if the values of their membership functions[7] are the same:

$\tilde{A} = \tilde{B} \leftrightarrow \forall x \in E: \mu_{\tilde{A}}(x) = \mu_{\tilde{B}}(x)$ (2)

In addition, Ã ⊆ B if all values of the membership function Ã are equal to or less than the corresponding values of B:

$\tilde{A} \subseteq B \leftrightarrow \forall x \in E: \mu_{\tilde{A}}(x) \leq \mu_{B}(x)$

It is called the level set ɑ of Ã to the sharp set $A_\alpha = \{x \in E / \mu_{\tilde{A}}(x) \geq \alpha\}$ (3)

Using this technique, an analysis will be carried out for several cases of planning of public budgets in Argentina, building research from a fuzzy zero base-budget. This last element allows to work with data that have a certain degree of uncertainty, coming from referential estimations of experts in the subject. The use of non-linear thresholds and non-triangular fuzzy numbers is then valid.

The information provided by the sample of experts will define, internally and externally, the operation of the allocation and distribution of resources in different public order managements, at a sector level. For the present analysis, we will take a sample in the sector "Government Administration".

The material will be studied under the premise that, both the practical implementation of the directives oriented and the results obtained, will have a certain degree of intensity in their realization and in the fulfillment of their objectives respectively, always within the categories of minimum, median and maximum activity.

To calculate the distance between the fuzzy numbers, we will use Kelley's definition[8] as a basis to delimit a distance or pseudometric of a set X as the function d of the Cartesian product X x X in the non-negative real numbers, such that for every element x, y, z ∈ X, is verified:

d (x, y) = d (y, x)

x = y ⇾ d (x, y) = O

d (x, y) * d (y, z) ≥ d (x, z) (triangular inequality)

where * according to Kaufmann and Gupta [9] is an operator associated with the notion of distance. The real number d (x, y) is called the distance from x to y. If in addition d (x, y) = O ⇾ x = y, then the function d is metric.

The distance between two continuous fuzzy numbers Ã and B of ℝ, expressed by ɑ: $A_\alpha = [a1(\alpha), a2(\alpha)]$ and $B_\alpha = [b1(\alpha), b2\ \alpha)]$, is obtained generalizing the distances to the left and right of the intervals for all values ɑ ∈ [0,1]. (Figures 1 and 2)

If $(a_1 - b_1)(a_2 - b_2) \geq O$, there is no intersection between the lines to the left

This distance is the area of the region indicated in Figure 1, which can be obtained by the sum of two defined integrals, called respectively, distance to the left and distance to the right:

$$d_I\left(\tilde{A}, \tilde{B}\right) = \int_0^1 |a_1(\alpha) - b_1(\alpha)|\, d\alpha$$

$$d_D\left(\tilde{A}, \tilde{B}\right) = \int_0^1 |a_2(\alpha) - b_2(\alpha)|\, d\alpha$$

$$d\left(\tilde{A}, \tilde{B}\right) = \int_0^1 |a_1(\alpha) - b_1(\alpha)|\, d\alpha + \int_0^1 |a_2(\alpha) - b_2(\alpha)|\, d\alpha$$

Figure 1

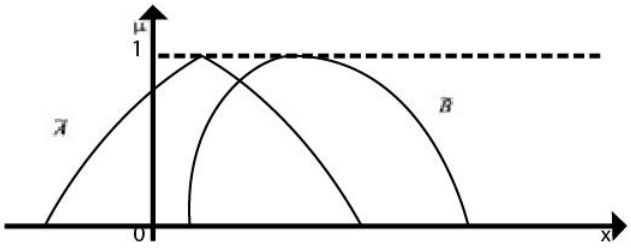


Figure 2

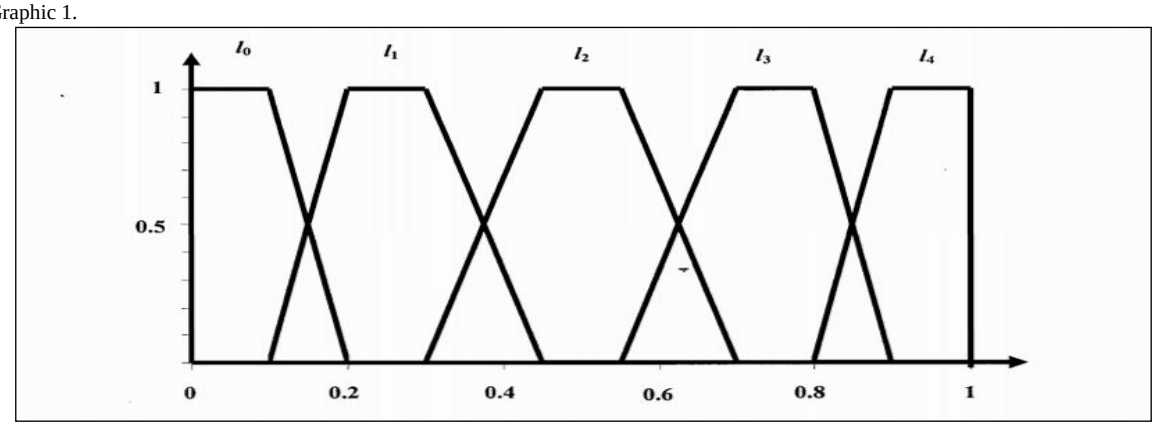
Through the aforementioned methods, it is feasible to determine responses to problems that include the human factor, inseparable from intrinsic variability and flexibility. Making the Fuzzy - Delphi an adequate option for the improvement of public management [9].

To process the information collected, the semantics specified in Table 1 were used, using in all cases a set of five cardinal terms. Its representation is shown in Graphic 1.

Table 1:

Label	Meaning	NBTr
l4	Very high	(0.80, 0.90, 1.0, 1.0)
l3	High	(0.55, 0.70, 0.80, 0.90)
l2	Neutral	(0.30, 0.45, 0.55, 0.70)
l1	Low	(0.10, 0.20, 0.30, 0.45)
l0	Very low	(0.0, 0.0, 0.10, 0.20)

Graphic 1.



The opinions of the experts who carried out the survey cannot be accurately reflected, given their high degree of subjectivity and the characteristic uncertainty of the political-social environment.

The fuzzy method has provided the necessary flexibility to model the numerical information in decision problems [10]. On the other hand, the diversity of the language and the form of expression of each subject of the sample can be represented and classified.

The questionnaires are applied to the Government Administration sector.

Results:

- Once the surveys were analyzed and processed, the following results were observed:
- In accordance with the approaches that meet the needs of the population, the definition of public policies is neither correct nor incorrect.
- The personnel in charge of delimiting public policies have limited information on the social and sectorial context.
- The objectives of public management in the Government Administration sector are undefined and inadequate.

- There are no metric models to check and analyze these objectives according to their efficiency, effectiveness, results, sustainability and impact.
- Government Administration sector policies partially comply with their priorities
- The objective assets of the Government Administration sector are barely adequate.
- Policies aggravate the internal regional imbalance of the State
- The policies of the Government Administration sector do not tribute to improve the economy at the international level.
- The policies of the Government Administration sector do not improve or worsen equity and regional growth
- The legislative framework of the Government Administration sector is not well defined.

3 Discussion

In response to the results obtained by the surveys, the public management developed by the Government Administration sector does not fully satisfy the needs of the population in the corresponding context. Among its main deficiencies, the lack of policies that contribute strategically to economic and social development [11] in the international framework and the lack of cohesion between the regions stands out. The latter is due to a scant analysis of the particularities of each territory when formulating a relevant policy.

As an immediate solution, it is proposed, in the first instance, to achieve an appropriate knowledge of the environment and a planning of changes by stages, defining deadlines and evaluating the viability of each policy or measure to be implemented.

It is important that joint work is carried out with the other sectors (Agriculture, Education and Culture, Energy, Industry, Promotion and Social Assistance, Water Resources, Drinking Water and Sewerage, Health, Transport, Housing and Urban Planning) to achieve the articulation of a sustainable mechanism and coherent implementation.[12]

The Government Administration sector must pursue long-term sustainability, with the support and consensus of the strategic plans of the State. For this, he needs goods that allow him to satisfy his needs; therefore, it must have a greater budget and control of the continuity and efficiency of its policies.

It is proposed to periodically make reports and inform the other sectors of reports on their project needs. It is also suggested to assess the level of urgency of the needs and implement trained structures, with procedural manuals correctly designed to analyze decisions.

Conclusions

After the analysis of the survey carried out in a sample corresponding to the Government Administration sector, the need to conceive new policies for public management was implicit. These must be based on a consensus among the different social actors and be based on the sustainable practice of a coherent and consistent framework with the different sectors that make possible the implementation of a plan for state management.

The results obtained by the neutrosophic analysis of the acquired data, evidence the lack of a progressive projection in the management of the Government Administration sector, so that it is suggested to work on the development of a plan with a view to economic growth and an opening to the international context.

The creativity, renewal and modernization of the analyzed sector emerge as essential aspects that should shape public management in the future, because only through them will be able to solve the problems of deficiency in the interaction between the political system and the administrative system of the State.

The need to study in depth the implementation of a plan that includes all sectors involved in public management is implied, as an alternative to the formulation of a new state plan that effectively addresses the main deficiencies in government and legislative State policies.

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Received: January 7, 2019. Accepted: May 18, 2019

Use of the Iadov method to measure the implementation of a program for sexual abuse prevention in Ecuador

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Abstract. This article is the result of the research carried out in Alejandro Rafael Mera Educational Unit, which aimed to implement a program for teachers and parents to prevent sexual abuse in children of that institution. Qualitative-quantitative research was carried out; Data were observed and collected through a survey directed to teachers and parents to determine the level of knowledge they have regarding sexual abuse. Once the program aimed at teachers and parents for the prevention of sexual abuse in children and adolescents is implemented, this program was validated using the Iadov method and neutrosophic logic, to determine the level of satisfaction existing about its implementation in the Alejandro Rafael Mera-Tulcán educational unit. Preventive strategies were developed as a part of the current Health model, where the main risk factors, consequences, and the most appropriate prevention measures were identified in order to reduce the risk of child sexual abuse.

Keywords: Prevention, sexual abuse, mental health, mental health in the infancy, Iadov method, neutrosophic logic

1 Introduction

In a study conducted by on "Child Abuse" it is evident that sexual abuse is a global problem with serious consequences that can last a lifetime.

In studies conducted by[1] on child sexual abuse in the first decade of the 21st century, it is evident that child sexual abuse is one of the least visible forms of violence. Unfortunately, it is a reality that hurts the family and society in a gross and cruel way. Most of the population considers this type of acts as belonging to people of no confidence, sociopathic who take refuge in remote and obscure places, far from the common gaze to commit these crimes. Certainly that happens, but there are other forms of sexual abuse that have underage victims, mainly female, among their victims, and they happen close, even inside, of the child's own environment.

According to in his article on "Sexual Violence in Latin America and the Caribbean" [2]it is said that the number of studies on sexual abuse in Latin America has increased in the last two decades, being one of the clearest manifestations of values, norms and traditions in a patriarchal culture that encourage men to believe that they have the right to control women's bodies and sexuality.

According to [3] in his study "Ecuador, the country of violence without limits" reveals that, in Ecuador, sexual violence from educational institutions is disguised by the same institutions, which generally blame children, adolescents or their mothers of these aggressions, generating even stigma, which dissuades other people from denouncing. And in spite of the existence of a route for the eradication of sexual crimes in the educational field this is not implemented, leaving without sanction the aggressors, being able to reach even more serious cases such as murder and rape of children. It is estimated that in Ecuador there is a strong underreporting of crimes of sexual violence against girls and adolescents, several fathers and mothers of assaulted children refused to file complaints for in fear that their sons and daughters will be stigmatized in the future.[4]

Refers [5], in his article published in the newspaper La Prensa "20 cases of indecent assault in the Carchi" he declares that Tulcan is the city with the most complaints filed, of all the complaints only eleven are resolved while the remaining nine are in process, according to different data it is established that most of these crimes occur within the family.

Based on the analysis carried out, it implements the sexual abuse prevention program in the Alejandro Rafael Mera-Tulcán educational unit. It is validated through the Iadov method and neutrosophic logic [6], techniques that constitute an indirect way to measure the satisfaction of users when making use or reference of the behaviors established by the prevention program on sexual abuse.

This technique is used, as suggested by the original method. The related criteria of answers to intercalated questions whose relationship the individual does not know, at the same time the unrelated or complementary questions serve as an introduction and support of objectivity to the respondent who uses them to locate and contrast the answers.

The result of these questions interacts through what is called the "Iadov Logical Table". In the present work, the satisfaction of the respondents is combined with the introduction of the neutrosophic estimation to look for a solution to the problems of indetermination that appear universally in the evaluations of the surveys and other instruments, taking advantage of not only the opposing and opposing positions, but also the neutral or ambiguous. Assuming that every idea <A> tends to be neutralized, diminished, balanced by ideas, in clear rupture with the binary doctrines in the explanation and understanding of phenomena [7].

2 Materials and methods

A descriptive study was carried out, modality of the qualitative-quantitative, non-experimental paradigm, where with a population of 970 parents and 40 teachers, formula 1 was applied to calculate the sample size.

$$n = N/(e\text{^}2.(N-1)+1) \ = 284 \qquad (1)$$

Where:

N = Total population

e = expected proportion (in this case 5% = 0.05)

N = 1 - N (in this case 1-0.05 = 0.95)

In this way, the research after application of educational strategies is carried out on 284 parents and 40 teachers. The inductive and deductive methods to obtain conclusions and the synthetic analytic allowed determining the current situation of knowledge of the subject; and the validation of results.

The Iadov method and neutrosophical logic are applied to measure the satisfaction of users when making use or reference of the behaviors established by the implemented prevention program on sexual abuse.

To apply the Iadov method and the neutrosophical logic, 21 subjects of the selected sample were selected, to whom a survey was applied, aimed at the knowledge and satisfaction that they have with respect to the implementation of the sexual abuse prevention program, in unit Alejandro Rafael Mera-Tulcán.

The survey was prepared based on 7 questions, three closed questions interspersed in four open questions; of which 1 fulfilled the introductory function and three functioned as reaffirmation and support of objectivity to the respondent.

The questionnaire used in the survey was useful to measure the satisfaction of users when making use or reference of the behaviors established by the prevention program on sexual abuse, implemented in the Alejandro Rafael Mera-Tulcán educational unit. To measure the impact of the implementation of the program, five questions were taken into account, three of which were closed and two open. The three closed questions correspond to the "Iadov logic table", which is presented adapted to the current investigation and is shown in table 1..

	1. Would it be appropriate to dispense with the prevention program on sexual abuse implemented in the Alejandro Rafael Mera-Tulcán educational unit?								
	No			I don't know			Yes		
2. Does the implementation of the prevention program on sexual abuse, implemented in the Alejandro Rafael Mera-Tulcán educational unit, meet your expectations?	3. If you could freely choose an option to measure if the implementation of the prevention program on sexual abuse implemented in the Alejandro Rafael Mera-Tulcán educational unit is appropriate, which one would you choose?								
	Yes	I don't know	No	Yes	I don't know	No	Yes	I don't know	No
Very satisfied.	1	2	6	2	2	6	6	6	6
Partially satisfied.	2	2	3	2	3	3	6	3	6

I don't care.	3	3	3	3	3	3	3	3	3
More unsatisfied than satisfied.	6	3	6	3	4	4	3	4	4
Not at all satisfied.	6	6	6	6	4	4	6	4	5
I don't know what to say.	2	3	6	3	3	3	6	3	4

Table 1: Logic table of V.A. Iadov to measure the satisfaction of users when making use or reference of the behaviors established by the prevention program on sexual abuse, implemented in the Alejandro Rafael Mera-Tulcán educational unit. Source: Own elaboration.

The number resulting from the interrelation of the three questions indicates the position of each respondent in the satisfaction scale, that is, their individual satisfaction. This satisfaction scale is expressed by SVN numbers. The original definition of truth value in neutrosophic logic is shown below [8].

Let N = {(T, I, F): T, I, F ⊆ [0,1]} n, a neutrosophic valuation is a mapping of a group of formulas propositional to N, and for each sentence p we have:

$$v(p) = (T, I, F) \quad (2)$$

With the purpose of facilitating the practical application to decision-making and engineering problems, the proposal of the single-value neutrosophic sets [7] (SVNS) was made, which allows the use of linguistic variables [8] and increases the interpretability in the recommendation models and the use of indeterminacy[9].

Let X be a universe of discourse. An SVNS A over X is an object of the form.

$$A = \{\langle x, u_A(x), r_A(x), v_A(x)\rangle : x \in X\}d \quad (3)$$

Where:

$uA(x)$: $X \rightarrow [0,1]$, $rA(x)$: $X \rightarrow [0,1]$ y $vA(x)$: $X \rightarrow [0,1]$, con $0 \leq uA(x) + rA(x) + vA(x) : \leq 3$ for all $x \in X$.

The interval $uA\ (x)$, $rA\ (x)$ and $vA\ (x)$ represents the true, indeterminate and false membership of x in A, respectively. An SVN number, to measure whether the implementation of the prevention program on sexual abuse, implemented in the Alejandro Rafael Mera-Tulcán educational unit is adequate, in the current study this result is expressed as $A = (a, b, c)$, where $a, b, c \in [0,1]$, and $+ b + c \leq 3$. The obtained SVN numbers are useful for recommendation systems.

To analyze the results, a scoring function is established. To sort the alternatives, an adapted score function [10] is used:

$$s(v) = T - F - I \quad (4)$$

In case that the evaluation corresponds to the indeterminacy (not defined) (I), a process of de-neutrosification was developed as proposed by Salmerona and Smarandache [10]. In this case, I ∈ [-1,1], Finally, we work with the average of the extreme values I ∈ [0,1] to obtain a simple value.

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

Where *vi* corresponds to the importance of the source. This proposal allows filling a gap in the literature of Iadov's techniques, extending it to deal with the indeterminacy and the importance of the user due to experience or any other reason [6].

Based on the aforementioned, to measure the individual satisfaction of each respondent, the individual satisfaction scale shown in Table 2 was used.

Expression	SVN Number	Score
Clear Satisfaction	(1, 0, 0)	1
More satisfied than dissatisfied	(1, 0.25, 0.25)	0.5
Not defined	I	0
More dissatisfied than satisfied	(0.25, 0.25, 1)	-0.5
Clear dissatisfaction	(0,0,1)	-1
Contradictory	(1,0,1)	0

Table 2. Scale of individual satisfaction. Source: [11]

3 Results

Regarding the evaluation of the level of satisfaction of the educational activities carried out on the sexual abuse of teachers and parents of the Alejandro R. Mera Educational Unit after applying the prevention program. The short and long term consequences and the preventive measures of sexual abuse are generally unknown, the parents do not have enough knowledge about what sexual abuse is. In the same way there was a high ignorance of topics related to sexual abuse, in particular how to identify a child who is a victim of sexual abuse, the consequences, how to help him and the preventive measures.

The importance of continuing to train teachers and parents of the Alejandro R. Mera Educational Unit, on the prevention of sexual abuse, is shown in the survey made this aspect as positive. The participants are unaware of the most appropriate measures to prevent sexual abuse. For which it is important to provide constant training to teachers and parents to achieve good prevention of child sexual abuse.[11]

It was verified that after applying the different strategies there is the capacity to identify a child who has been a victim of sexual abuse, since they know the indicators to determine if a girl, a child, or adolescent is being a victim of sexual abuse. It demonstrates the importance of the implementation of the prevention program to contribute to the knowledge that the participants have, thus preventing the sexual abuse of children.

The result of applying the IADOV technique to the criteria presented in the survey to measure the satisfaction of users when making use or reference of the behaviors established by the prevention program on sexual abuse, implemented in the Alejandro Rafael Mera-Tulcán educational unit, is shown in table 3.

Expression	Total	%
Clear Satisfaction	17	70.8
More satisfied than dissatisfied	7	29.2
Not defined	0	0
More dissatisfied than satisfied	0	0
Clear dissatisfaction	0	0
Contradictory	0	0

Table 3: Results of the application of the IADOV technique to measure the satisfaction of the users to make use or reference of the conducts that establishes the program for sexual abuse prevention. Source: self-made

The calculation of the score is made and the calculation of Iadov is determined, for our case of study a value was assigned in the vector of weights equal $w_1 = w_2 = \cdots = w_i = 0.047$. The final result of the method is ISG = 0.86, showing that there is a high level of satisfaction on the part of users when making use or reference of the behaviors established by the implemented prevention program on sexual abuse.

Conclusion

After the implementation of the strategies, teachers and parents of the Alejandro R. Mera Educational Unit have extensive information regarding child sexual abuse, its risk factors, consequences and prevention measures, that is, they already know how to prevent child sexual abuse.

Teachers and parents took the educational program with the best acceptance because it is an activity for the health of their children, obtaining positive results, thanks to education on prevention of sexual abuse.

The process of measuring user satisfaction by making use or reference of the behaviors established by the

prevention program on sexual abuse, implemented through the neutrosophic Iadov technique, quantitatively expressed a high satisfaction rate with regard to the behaviors established by the prevention program on sexual abuse, implemented in the Alejandro Rafael Mera-Tulcán educational unit.

The results obtained were of vital importance to verify the quality, validity and feasibility of the suggested proposal, demonstrating that education contributes to prevent sexual abuse in children and adolescents of the Alejandro R. Mera Educational Unit, and improve their life quality, allowing them to achieve social and emotional well-being.

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Received: January 10, 2019. Accepted: May 8, 2019

Neutrosophic model for the analysis of the causes that lead to tax fraud

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Abstract. Economic fraud has been a crime little controversial in the media and social networks, because it is classified as one of the white-collar crimes, which are those that are committed by economic powers. For such a reason, the objective of this investigation is to carry out an analysis of the causes that lead to tax fraud. Making use of Neutrosophy, for the sake of recommending the causes to keep in mind to make a distinction of those more used in the administrative sanctions according to what is stipulated by Article - 298 of the Integral Organic Penal Code, in Ecuador. For gathering the information, we used qualitative techniques such as the bibliographical revision, as well as the not participant observation of the news to buy the doctrine with the facts of social shock. The main result is the determination of the privation of freedom in cases that the tax fraud constitutes crime.

Keywords: Fraud, accounting, punishment, crime, falsification, simulation, neutrosophic model.

1 Introduction

It is important for the development of this topic and its respective analysis to understand that a tax fraud crime can be deceitful or wrongful, this way being able to identify the graveness of each delinquent behavior established in the Integral Organic Penal Code (COIP) in tributary matter[1]. Therefore, we may say that deceit is present, so the person that incurs in tax evasion does it to obtain wealth in his own benefit, from money that belongs to the State to make effective the common good.

In tax matters, constitutes a fraud all deceitful act of simulation, concealment, omission, falsehood or deceit that leads to error in the determination of the tax obligation, or for what is evaded to pay totally or partly the actual tributes, in own benefit or in that of a third. As well as those deceitful behaviors, that contravene or hinder the control works, determination of sanction exercised by Tax Administration [2].

The lack of transparency, scarce cooperation, delivery of almost null information, create favorable conditions so that they can accumulate enormous capitals of unknown origin and in many illicit cases in abroad institutions. Tax fraud constitutes material object of money laundering crime, ratifying the accountant's penal responsibility as the author of the fraud, inclusive if he has not acted with expressed command. That's why, legal representatives and the accountant, regarding the declarations or other actions they make, will be held responsible as authors of the tax fraud in the legal or natural person's benefit. Without damage of the responsibility of the partners, shareholders, employees, workers or professionals that have participated deliberately in this fraud, although they have not acted under any command[3].

In front of the doctrinal opinion, a relationship between the tax fraud and the money laundering crime, it is been analyzed the possibility to determine the existence of a tax fraud crime when the profits coming from a money laundering crime are hidden to the tax administration. That is, in this scenario, they have been debating if the illicit patrimonial increment (that constitutes the material object of the money laundering crime) should be subject to taxes. Second, they discuss the possibility of the obtained earnings of a tax fraud may be object of money laundering [4].

The discussion in Spain about the legal penal good in the crime of tax fraud in particular, and in the crimes against the Public Treasury in general, is confronted between the patrimonial and functional thesis, being appropriate to approach a material concept in the crime of tax fraud starting from considering the Criminal Law as protector of juridical goods[4] .

In Peru, they began a process of permanent pursuit of cases that are firmly sentenced to convictions for fraud crime (false bills). This indicator shows their interest in fighting against fraud cases and organizations selling false invoices, which is a very important evasion way. It is worth pointing out that there are very few tax fraud crimes cases with a firm sentence. It is considered that the Legal Power has to be more effective, it is another of the reformations that should be done since up to this date there are very few firm sentences through the legal way of punishment for tax fraud. It is proposed, as a legislative initiative, the urgent specialization of the criminal courts in tax matters for it would contribute in a great way to decrease the tax fraud crimes having the tax evasion as its main cause [4].

The principle of law reservation has been instituted at Constitutional level. In Bolivia, they have a minimum system of law reservation, since it attributes to the assembly the obligation of legislating in both the noun and adjective ambit. In Ecuador, we may observe surveillance of the infra legal normative acts regulating nouns aspects of the Criminal Law. A matter that has come to commit the principle of law reservation in this sense and with a hierarchically inferior range, we have the case of the ordinance of the Metropolitan District of Quito on public shows. In addition, it is evidenced that in the criminal law for administrative infractions, deprivation of liberty is not considered, because it is reserved for bigger crimes. It is recommended, in the Organic Code of Territorial Organization, Autonomy and Decentralization (COOTAD), to clearly establish the powers and competencies that are delegated to the levels of sectional government, so that they do not overstep in the creation of taxes .

Theory of duty Infraction is sustained by the fact that the duty being protected it is that of contributing with the State in the maintenance of the public expenses, which is supported by numeral 15 of article 83 of the Constitution of the Republic. For the existence of tax fraud crime, the subjective element "deceit" should be present. In consequence, those infractions whose deceitful behavior cannot be proven may be categorized as administrative infractions (regulation breaches) established in the Tax Organic Code, but not as fraud. Nevertheless, Ecuador is a constitutional State of rights and justice that should guarantee the citizens their right to the presumption of innocence[5].

Tax is an obligation originated centuries ago, there are even biblical quotations referring to it. Today, Ecuador has to take the road to the adoption of a tax culture. It is necessary to insist on the intent of an awareness process, even more when our idiosyncrasy is in the middle of it. Not as much as a decrease of our self-esteem but for the ancestral habit for the evasion. Therefore, the tribute seen from the pure meaning of the word is an imperative of the civilized societies, where everyone must consciously contribute with the state to improve the standard of life[6].

Educational strategies are very relevant to develop a tax conscience and moral of the citizens through the training, developing in individuals the knowledge about the duties and rights for taxpayers in a tax system. As well as the creation of ethical values, to establish a detailed and integral understanding on the fiscal norms, guided to the voluntary payment of the taxes. Playing an active part, not only in the cancellation of the obligations as for the investment of resources and the evasion by entities or fellows belonging to a society that conceive a detriment in the social goods[7] .

Throughout this study, we will carry out a clear analysis on the tax fraud, a crime that is declared in article 298 of the Integral Organic Penal Code due to its paramount importance. It is erroneously believed that carrying out some of the acts described in this work would lead to just an administrative and pecuniary sanction, when in fact doing so would be incurring in a crime that derives in privation of freedom sanctions.

Based on analysis related to the crimes committed in the tax fraud field, in this study we make use of Neutrosophy to analyze the causes that lead to tax fraud, to recommend the causes to keep in mind to make a distinction on those more common in administrative sanctions. The study from Neutrosophy contributes to the treatment of the neutralities, to treat the non-determination present in the information for the support to decision-making. Neutrosophy has created the bases for a series of mathematical theories that classic and diffuse theories generalize, such as Neutrosophic sets and logic[8][9].

2 Materials and methods

We carried out a non-experimental descriptive investigation. Starting with the use of qualitative techniques as base of the study for the appropriation and understanding of concepts and theories related to the investigation, information, texts, legal regulations and other documents, using bibliographical records that facilitated the development of the discussion and the obtaining of results. Bringing into debate the causes leading to tax fraud. Specifically, through the observation of the situations that took place in Ecuador, particularly based on the revision of news broadcasted in the national media, in order to relate them to the bibliographical foundation.

We also identified deficiencies in the causes that are frequently used to configure tax fraud crime, each one with their own rector verbs and constituent elements, for which a Neutrosophic recommendation model was designed. Which is useful in the decision-making process since it provides a group of options that are expected to satisfy its expectations [10].[11]

This investigation proposes a recommendation model based on the knowledge of the analysis of the causes that lead to tax fraud, using single value Neutrosophic numbers (SVN) which allows the use of linguistic variables [12].

For our case study, having X as the speech universe and a SVNS A over X which is an object defined as follows:

$A = \{\langle x, (x), r(x), vA(x)\rangle: x \in X\}\ d$ (1)

Where $uA(x)$: $X \rightarrow [0,1]$, $rA(x)$, $:X \rightarrow [0,1]$ y $vA(x)$: $X \rightarrow [0,1]$ with $0 \leq uA(x) + rA(x) + vA(x) : \leq 3$ for every $x \in X$.

The interval (x), $rA(x)$ y $vA(x)$ represents the true, uncertain and false memberships of x in A, respectively. For the sake of convenience a number SVN will be expressed as $A = (a, b, c)$, where $a, b, c \in [0,1]$, y $+ b + c \leq 3$.

In this research, the recommendation pattern is made starting from the information of the analysis of the causes that lead to tax fraud. In particular, a content-based recommendation pattern is used, where they learn from the stored profiles about the causes that lead to tax fraud in Ecuador and the profiles whose characteristics are present in the causes that configure the tax fraud in Ecuador, particularly those that correspond to article - 298 of the Integral Organic Penal Code in Ecuador.

The proposed pattern is shown in figure 1. It is based on the proposal of Cordon [12] for the knowledge-based recommendation systems, which allows to represent linguistic terms and non-determination by means of SVN numbers.[13]

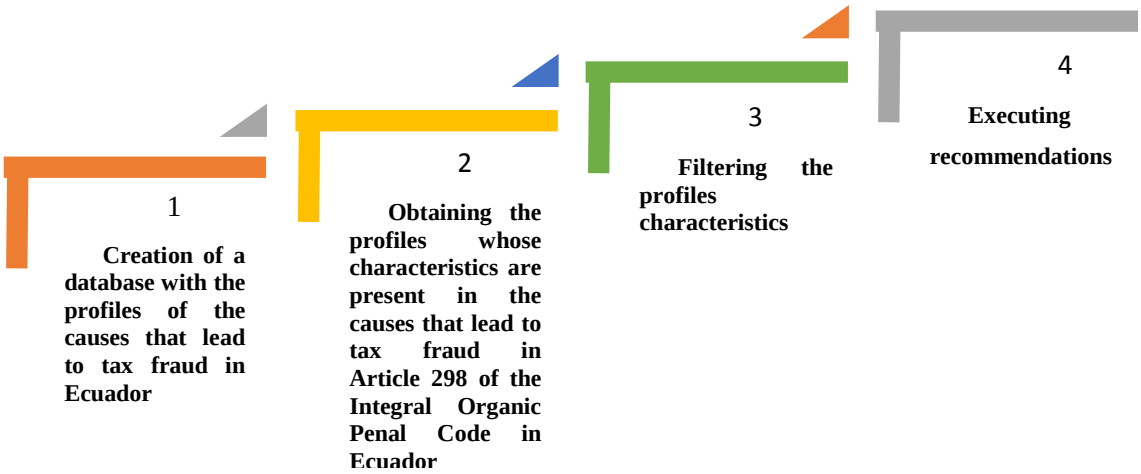

Figure 1. Recommendation pattern starting from the information of the analysis of the causes that lead to tax fraud in Ecuador.

1. Creation of a database with the profiles of the causes that lead to tax fraud in Ecuador

In this component we create the database that will contain the profiles of the characteristics of the causes that lead to tax fraud in Ecuador. Each profile will contain the causes, which will be represented as ai. These profiles describe the group of characteristics related to the causes that lead to tax fraud in Ecuador.

$$C=\{c1,\ldots,ck,\ldots,cl\} \quad (2)$$

The characteristics of the profiles of the causes that lead to tax fraud in Ecuador, stored in the database previously created, are obtained by means of Neutrosophic single value numbers (SVN) [14]. These characteristics are evaluated considering that $A* = (A1* , A2* , .., An*)$ is a vector of SVN numbers that corresponds with the characteristics of the causes that lead to tax fraud, such that $j *=(aj*, bj*, cj*)$ j=(1,2, … , n) and $Bi = (Bi1, Bi2, \ldots , Bim)$ $(i = 1,2, \ldots , m)$ when there are several vectors (m) corresponding with n SVN numbers such that and $Bij = (aij, bij, cij)$ $(i = 1,2, \ldots , m)$, $(j = 1,2, \ldots , n)$. Euclidean distance can be measured with the purpose of obtaining a measure of similarity among the stored characteristics.

Euclidian distance calculation is carried out according to equation 3, which is defined b as:

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

Based on Euclidian distance calculation a measure of similarity is defined, as referred by [15]. With the result of this calculation, we analyzed the approach of the characteristic of the causes that lead to tax fraud Ai, being noteworthy that the smallest the distance of the characteristic of the causes (si) the bigger the similarity. Which allows sorting the characteristics of the causes that lead to tax fraud [16].

Profile may be obtained in a direct way based on experts' criteria using equation 4.

$$F_{a_j} = \{v_1^j, \ldots, v_k^j, \ldots v_l^j\}, j = 1, \ldots n \quad (4)$$

The assessments of the characteristics of the causes that lead to tax fraud in Ecuador, aj, are expressed using the linguistic scale, where:

S= {s_1, …, s_g} is the set of defined linguistic terms to assess the characteristics c_k using SVN numbers.

In this study, linguistic terms are defined once described the set of $^{S,}\ v_k^j \in S$ products, through the use of expression 5.

$$A=\{a_1,\ldots,a_j,\ldots,a_n\} \quad (5)$$

2. Obtaining the profiles whose characteristics are present in the causes that lead to tax fraud in Article-298 of the Integral Organic Penal Code in Ecuador

In this component, we obtained the information of the profiles whose characteristics are present in the causes that lead to tax fraud in the article - 298 of the Integral Organic Penal Code, in Ecuador. These profiles are stored in the database and are mathematically represented by expression 6.

$$P_e = \{p_1^e, \ldots, p_k^e, \ldots, p_l^e\} \quad (6)$$

Each profile will be integrated by a set of attributes, mathematically represented as shown in expression 7

$$C^e = \{c_1^e, \ldots, c_k^e, \ldots, c_l^e\} \quad (7)$$

where: $c_k^e \in S$

The value obtained using the so-called conversational approach or through examples that can be adapted according to [14].

3. Filtering characteristics of the profiles

In this component, we filter the characteristics of the profiles of the causes to make a distinction of those more used in the administrative sanctions according to what defines Article - 298 of the Integral Organic Penal Code in Ecuador.

With that purpose, the similarity *S* is calculated, among the profiles of the causes that lead to tax fraud in Ecuador and the profiles whose characteristics are present in the causes that lead to tax fraud in Ecuador. In particular, those that correspond with Article - 298 of the Integral Organic Penal Code in Ecuador. Those profiles are denoted by *Pe*. The characteristics are represented as *aj* [16] and they are the ones stored in the database, where the calculation of the total similarity is carried out, which is mathematically represented through expression 8.

$$s_i=\left(1-\frac{1}{3}\sum_{j=1}^{n}\left\{\left(\left|a_{ij}-a_j^*\right|\right)^2+\left(\left|b_{ij}-b_j^*\right|\right)^2+\left(\left|c_{ij}-c_j^*\right|\right)^2\right\}\right)^{\frac{1}{2}} \quad (8)$$

4. Executing recommendations

Calculated the similarity among the values of the characteristics of the profiles on the causes that lead to tax fraud in Ecuador and the profiles whose characteristics are present in the causes that lead to tax fraud in Ecuador, in particular those that correspond with Article - 298 of the Integral Organic Penal Code. These characteristics are sorted according to the similarity obtained and they are represented by the vector of similarity described in expression 9.

$$D=(d1,\ldots,dn) \quad (9)$$

Best characteristics will be those that better satisfy the needs of the profiles of the causes that lead to tax fraud in Ecuador. That is, the ones with bigger similarity.

3 Results

The result of this investigation is the identification of each cause so that the tax fraud crime is configured developing 18 causals, each one with its own rector verbs and constituent elements. The causes identified having more incidence and leading to tax fraud crimes are:

1. Use of false identification or identity in the application for registration, updating or cancellation of the records kept by the tax administrations.
2. Use of false or adulterated data, information or documentation in the application for registration, updating or cancellation of the records kept by the tax administrations.
3. Execution of activities in an establishment knowingly that it is closed.

4. Use of sales or retention vouchers or complementary documents that are not authorized by the Tax Administration.
5. Provide the tax administration with reports with false data, figures, goods, circumstances or false, incomplete, distorted or adulterated records.
6. Make statements in the tax returns of false, incomplete, defaced or adulterated data, provided that the taxpayer has not exercised, within one year after the declaration, the right to submit the substitute statement in the manner provided by law.
7. Falsification or alteration of permits, guides, invoices, records, marks, labels or any other type of control of production, consumption, transport, import and export of burdened goods.
8. Alteration of settlement in accounting books or registers of accounts, of operations related to economic activity, as well as the accounting record of false accounts, names, amounts or data.
9. Double accounting with different entries in books or computer records, for the same business or economic activity.
10. Total or partial destruction of books or computerized accounting records or other regulations required by tax or the documents that support them, to evade payment or decrease the value of tax obligations.
11. The sale for consumption of uncorritated liquor or alcohol without bottling which leads to falsely declaring the volume or alcoholic degree of the product subject to the tax, outside the tolerance limit established by the INEN. As well as the sale outside the quota established by the Service of Internal Revenue, of the ethyl alcohol destined to the manufacture of alcoholic beverages, pharmaceutical products and eau de toilet.
12. The issuance or acceptance by the tax administration of sales receipts, retention or supplementary documents for non-existent operations or whose amount does not coincide with that corresponding to the actual operation.
13. Emission of sale vouchers for operations carried out with company's ghosts, non-existent or supposed.
14. The presentation to the tax administration of sales receipts for operations carried out with ghost or nonexistent companies.
15. The omission of income, which includes costs, expenses, deductions, exemptions, rebates or withholdings that are false, nonexistent, or superior to those that proceed legally, to avoid paying the corresponding taxes.
16. The extension to third parties of the benefit of a right to subsidies, rebates, exemptions, fiscal stimuli or benefit from them without rights.
17. The simulation of one or more acts, contracts to obtain or give a benefit of subsidy, reduction, exemption or fiscal stimulus.
18. The existence of a lack of deliberate, total or partial delivery by the agents of withholding or collection of taxes withheld or received, after ten days of expiration of the term established in the standard to do so.

It is important to indicate that the tributes retained by the retention or perception agents is money that belongs to the State and for that reason to the whole collective, therefore, failure to comply with the payment in the terms and conditions established by law, is one of the penal types of tax fraud. They are considered as withholding or collection agents by regulation, administrative or legal mandate for which they must retain VAT and / or INCOME and the tax withheld or received must be paid to the State within the corresponding time.

Natural or juridical persons forced to register accounting are those that have to act as retention agents' or perception. The concept of agents of retention and perception are established in Art. 29 of the Tax Code, art. 45 of the Internal Tax Regime Law.

Retention agents are natural or legal persons who, because of their activity, function or employment, are in a position to withhold taxes because, by legal mandate, regulatory provision or administrative order, are obliged to do so.

Similarly, perception agents are the natural or legal persons who, because of their activity, function or employment, and by mandate of the law or regulation, are obliged to collect taxes and deliver them to the active subject.

These characteristics are analyzed through a Neutrosophic model based on the recommendation pattern developed by [17]. For our case study and making use of the previously created database that stores the characteristics of the study profiles, the vector that represents the causes having similarity among the profiles stored in the database is used.

These causes are the ones that lead to tax fraud and the more used in the administrative sanctions according to that defined by Article - 298 of the Integral Organic Penal Code in Ecuador. They can be expressed as:

$$A = \{a1, a2, a3, a4, a5, a6, a7, a8, a9, a10, a11, a12, a13, a14, a15, a16\}$$

They are described by the set of attributes:

C= {c1,c2,c3,c4,c5, c6,c7,c8,c9,c10,c11,c12,c13,c14,c15,c16}

The attributes will be valued in the linguistic scale shown in table 1. The assessments are stored in the previously created database.

Linguistic terms	**SVN Numbers**
Extremely good (EG)	(1,0,0)
Very very good (VVG)	(0.9, 0.1, 0.1)
Very good (VG)	(0.8,0.15,0.20)
Good (G)	(0.70,0.25,0.30)
Moderately good (MDG)	(0.60,0.35,0.40)
Medium(M)	(0.50,0.50,0.50)
Moderately bad (MDB)	(0.40,0.65,0.60)
Bad (B)	(0.30,0.75,0.70)
Very bad (VB)	(0.20,0.85,0.80)
Very very bad (VVB)	(0.10,0.90,0.90)
Extremely bad (EB)	(0,1,1)

Table 1: Linguistic terms used by [15].

In order to receive the recommendations, information is provided according to the similarity obtained from the profiles analyzed on the causes that constitute the tax fraud. Based on the characteristics of each identified cause, the causes used in the administrative sanctions are obtained as established by Article - 298 of the Integral Organic Penal Code in Ecuador, outstanding the causes:

A= {a4,2,a1,a3,a8,a6,a7,a5}

The similarity between the profiles of the causes that lead to tax fraud in Ecuador and the profiles whose characteristics are present in the causes that lead to tax fraud in Ecuador, in particular those that correspond to article - 298 of the Integral Organic Penal Code, are the ones shown in table 2.

$\boldsymbol{a}$4	$\boldsymbol{a}$**2**	$\boldsymbol{a}$1	$\boldsymbol{a}$3	$\boldsymbol{a}$8	$\boldsymbol{a}$6	$\boldsymbol{a}$7	$\boldsymbol{a}$5
0.54	0.86	0.52	0.84	0.42	0.92	0.44	0.89

Table 2: Similarity between products and user's profile**.**

Based on the results shown in table 2, the recommendation is made on the causes to be taken into account to make a distinction between the most used administrative sanctions as established by Art. 298 of the Integral Organic Penal Code in Ecuador. They are evaluated through linguistic terms represented in table 1, their result in linguistic terms is:

Pe={G,VG,G,VG,MDG,VVG,MDG,VG}

A sorting of causes is:

{a6, a5, a3, a2, a4, a1, a7, a8}

In case the recommendation is made for the causes to be taken into account to make a distinction of the most used in administrative sanctions as established by Art. 298 of the Integral Organic Penal Code in Ecuador, these will be the ones with bigger weights, being selected the causes shown in the following vector:

a6, a5, a2, a3.

On the other hand, it is necessary to highlight that the approaches of [7] are asserted. And it is proposed to carry out a bigger control of tax performance of the taxpayers, on behalf of the tax Administrations, in order to discourage the population from nonfulfillment. The Constitutional Court should also declare the unconstitutionality of the cases classified as tax fraud that are opposed with the principles of the tax regime and principles of the proper process defined in the Constitution of the Republic of the Ecuador. And to repeal the juridical suppositions established in numeral 3, 4 and 10 of the Integral Organic Penal Code as tax fraud since they infringe the principle of minimum penal intervention; and classify them as administrative contraventions in the Tax Organic Code.

Conclusions

It is pertinent to conclude that tax fraud is constituted as an offense sanctioned by the current normative criminal law. A person older than 18 years-old can be punishable when he does not legally comply with the provisions of the tax legislation and, consequently, will incur in the causes defined in Article 298 of the Integral Organic Penal Code.

In essence, tax fraud is committed through concealment, which are undeclared or omitted income, or not to submit to tax control agencies the amount of withholding or payment of taxes that may have been made within the period established by law.

Taxpayers who incur in this crime may also be subject to fines according to the severity of the crime.

A neutrosophic model was constructed for the analysis of the causes that lead to tax fraud in Ecuador. 18 causes were detected, out of which the model recommends taking into account the causes 6, 5, 2, 3, which are the more frequently used in administrative sanctions as established by Article 298 of the Integral Organic Penal Code in Ecuador.

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Received: January 7, 2019. Accepted: May 26, 2019

Neutrosofic Iadov for the analysis of satisfaction on the regularities in the international legal field concerning the human rights of migrant workers in Ecuador

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Abstract. Legal norms regulate the situation of migrants. At international level, however, they are primarily responsible for establishing fundamental human rights, but the normative development of both the United Nations and the ILO focuses primarily on analyzing the situation of migrant workers in regular status, which leaves aside the situation of irregular migrant workers. The method of document content analysis was used to review and assess various sources, studies and legal documents. In the same way, the analytical-synthetic method is used, which makes it possible to integrate the most important normative and jurisprudential sources. In order to support the validation, the IADOV method and the neutrosophic logic were applied for the analysis of satisfaction on the irregularities in the international legal field related to the human rights of migrant workers in Ecuador.

Keywords: Migration, legislation, Irregularity, discrimination, equality, IADOV , neutrosophic logic

1 Introduction

The United Nations Convention on the Protection of the Rights of All Migrant Workers and their Families, adopted by the General Assembly of the United Nations in its resolution 45/158 of December 18, 1990 makes reference in its introductory headings to the new reality of the migratory phenomenon. The norm, in that section, points out the need to adopt measures to "prevent and dissuade" irregular immigration by recognizing the fundamental human rights of migrant workers. At the same time, this legal norm in its 1st article defines the concept of migrant worker and in this respect establishes that it is "any person who is going to carry out, carries out or has carried out a remunerated activity in a State of which he is not a national"[1].

The mentioned convention establishes that although all migrants have a common characteristic (living and working in a country of which they are not nationals) they also face other problems, among which stands out that having to form part of a society that is not their own, could discriminate against them in accordance with this "migrants are a highly vulnerable group. They often suffer from various forms of exploitation and serious abuses of their human rights and dignity".

This legal consecration for the academic world involves analyzing several questions. First of all, the norm recognizes this right for all migrants, but it must be taken into account that these people can have two specific conditions: to be in a regular situation or not. Thus, the norm establishes that this factor does not influence fundamental human rights, and that they must be respected, but, in addition, the convention states that legal migrants did benefit from the legitimacy of claiming more rights than undocumented migrants. However, we cannot fail to say that this consecration of the fundamental human rights of all migrants marks a milestone in the history of this collective and in this regard, it points to a sector of the doctrine that is a consequence of the work of the UN in recognizing the sensitive situation of these people through the protection and assurance of their fundamental human rights [2].

It is necessary to analyze this reality in greater depth, given that this recognition, in the case of the situation of migrants is essential, considering that migrants are people who are already at risk of being socially excluded by the receiving State from the point of view of its members. Seen in this way, this enshrinement of fundamental human rights is "a radically necessary instrument in the fight against the same (discrimination) for these people" [3].

The cited author refers that universality is "drastically reduced by the state or national policies on them and their constitutional particularization as a fundamental right of nationals, which generates a technical legal limitation of its universality.

The normative enshrinement is complemented by the New York Declaration for refugees and migrants number 70/1 of September 19, 2016 that in its paragraph II on the commitments that apply to both refugees and migrants. Specifically in its normative provision number 23 seeks to ensure the effective protection of the human rights of all migrant workers (regardless of their regular or irregular status).

In this regard, the establishment of some measures that allow the protection of these people is placed as a commitment for the current year 2018. Among them, it is specifically established the need to include these policies that we mention here in a future Global Pact for safe and orderly migration and to regulate this according to section number 1 on the commitments, in its normative disposition number 21.

The normative regulation as it is pointed out by a sector of the doctrine [2] in the work of the ILO highlights certain standards namely. One of them of special importance would be Convention No. 97 of 1949 concerning Migrant Workers. Which entered into force on January 22, 1952, and which establishes in its Article 6 that all States Parties shall apply to all immigrants without any type of discrimination treatment no less favorable than those who apply to nationals, and in this way equal remuneration should also be applied where the norm expressly mentions women in that normative provision.

Thus, with regard to Convention 97 in commentary we can say that, in its regulatory provision number 6, it establishes that each Member State is obliged to apply to migrants in a regular situation equal treatment to nationals without any discrimination on any grounds such as race, religion or sex. In addition, at the time of its application the ILO has pointed out that there are tangible inequalities suffered specifically in relation to working conditions, remuneration and social security. The organization notes, for example, that this has been happening in countries such as China, France, Norway and Israel. It is striking that the legislator mentions exclusively for the applications of favourable treatment to migrants in a regular situation, since, in this way, the ILO makes it clear that it will continue with the same "guarantee" parameter of the United Nations. [4]

In another sense, in 1978 the Convention number 143 was adopted on migration in abusive conditions and the promotion of equality of opportunities and treatment of migrant workers, which entered into force on December 9, 1978. The doctrine recognizes from this rule that because it deals with these two issues, it is thus divided into these "two substantive parts" [5]. It is a legal norm that in principle effectively promotes the rights of workers and especially of workers in a regular situation. With regard to the first commentary, it states in Article 1 that "Each Member for which this Convention is in force undertakes to respect the fundamental human rights of all migrant workers". A doctrinal commentary [3] that is considered prudent at this time and in relation to the Convention points out that these "fundamental human rights" are not specified in the Convention.

Thus, it is possible to mention Article 2, which establishes that it is the obligation of Member States to determine whether irregular migrant workers are found within their territories, in order to promote the regulation of the administrative situation of these persons and to eradicate trafficking of human beings. According to the article, it must be determined whether there are movements of migrants in the territory of these Member States with the purpose of working, and at the same time it must be analyzed whether these persons are subjected during their trip, arrival or stay to any type of circumstance that violates the international instruments or other agreements that may be established on this matter.

The doctrine points out in this section that the most relevant part of this first part of the norm is the fight against the illegal employment of migrants "but beyond that, the persecution of irregular work" [3]. Thus, like the doctrine in commentary, we believe that the regulation of migrants tends to set aside what he calls "other situations that migrants may suffer without authorization to reside in the country and that we complement by saying that they leave aside their social rights, a collective responsibility that is derived from social progress, with the declaration of nature as a subject of law in Ecuador being upheld in a new paradigm of South American legal sciences [4], of which we will fully discuss in this chapter".

With respect to this regular migration of persons, article 9 deals with this issue, stating that in the case of migrants in an irregular situation "Without prejudice to the measures adopted to control migratory movements for the purpose of employment", they must enjoy the same equality of treatment with respect to questions relating to remuneration, social security and other benefits corresponding to their previous employment, when this regulation has not been respected or when their situation cannot be regularized, since for [5] it is stable that these elements are those that later allow the understanding of the different achievements of the human being.

It is also of interest that, in relation to the irregular situation of these workers, Article 3 of the regulations stipulates that Member States shall adopt the necessary and appropriate measures relating to the scope of their own jurisdiction for the purpose of two fundamental questions: to suppress irregular or clandestine migration for the purpose of employment, or even the illegal employment of migrants, and to combat such persons or organizations of illegal movements for the purpose of employment coming from, going through or transiting their territory. The norm again refers to migrant workers in an irregular condition because, as has been said, it extends equal treatment to some fundamental issues in the world of work such as remuneration or social security. However, the same criterion that has been used for its ulterior purpose is therefore the eradication of this administrative status.

The work of the ILO is not limited only to this type of standards analyzed. In fact, in 2005 it adopted the Multilateral Framework for Labour Migration, which sets out some guidelines to be followed by the member States of the organization. Doctrine [4], in accordance with the comments we made on Convention 143, indicates that this framework in Principle 8 established as it does that "all migrant workers should enjoy the principles and rights contained in the ILO Declaration and in the relevant United Nations Conventions on Human Rights". Therefore, the doctrine concludes that this framework concretizes those rights mentioned in Convention 143, analyzed previously.

Considering the aforementioned, the question arises as to whether the irregularities in international human rights law have an impact on migrant workers in Ecuador.

For this reason, international human rights law irregularities are validated using Iadov's technique and neutrosophic logic, [6] techniques that are an indirect way of measuring the reversal of the burden of proof over the non-existence of untimely dismissal.

This technique uses, as stated in the original method, the related criteria of answers to interspersed questions whose relationship is unknown to the subject. At the same time, the unrelated or complementary questions serve as an introduction and support of objectivity to the respondent who uses them to locate himself and contrast the answers.

The result of these questions interacts through what is called "Iadov's Logical Chart", in this work the satisfaction of the respondents is combined with the introduction of the neutrosophic estimation to seek a solution to the problems of indetermination that appear universally in the evaluations of the surveys and other instruments, taking advantage not only of the found and opposite positions but also of the neutral or ambiguous ones. Starting from the fact that every idea < A > tends to be neutralized, diminished, balanced by the ideas, in clear rupture with the binary doctrines in the explanation and comprehension of the phenomena.

2 Methods

This research was developed under the method of documentary analysis of content, which allowed the review and assessment of all types of sources and doctrinal and legal documents that referred to the topic of study. This is how the analytical-synthetic method was used, which allowed that through the analysis of this type of sources an integration of the most important could be made in order to comply with the general and specific objects of this research. That is why all the information contained in this research is the result of the analysis and legal study of normative documents combined with their doctrinal analysis. Another of the techniques used was the survey, for the development of which a sample of 21 subjects was considered. The survey was elaborated with 7 questions, three closed-ended questions interspersed in four open-ended questions; of which 1 fulfilled the introductory function and three functioned as a reaffirmation and support of objectivity to the respondent.

The questionnaire used in the survey was useful to measure whether the irregularities in the international legal sphere relating to human rights affect migrant workers in Ecuador, to anticipate, design and measure the impact of the problem, five questions were taken into account, of which three were closed and two were open. The three closed-ended questions correspond to the "Iadov Logical Chart", which is presented adapted to this research and shown in Table 1.

	Would it be appropriate to dispense with irregularities in the international legal sphere relating to human rights in Ecuador?								
	No			I don't know			Yes		
5. Does the application of the analysis to measure whether irregularities in international human rights law affect migrant workers in Ecuador meet your expectations?	6.If you could choose freely, an option to measure whether the irregularities in the international legal sphere relating to human rights affect migrant workers in Ecuador, which one would you choose?								
	Yes	I don't know	No	Yes	I don't know	No	Yes	I don't know	No
Very satisfied.	1	2	6	2	2	6	6	6	6
Partially satisfied.	2	2	3	2	3	3	6	3	6
I don't care.	3	3	3	3	3	3	3	3	3
More unsatisfied than satisfied.	6	3	6	3	4	4	3	4	4
Not at all satisfied.	6	6	6	6	4	4	6	4	5
I don't know what to say.	2	3	6	3	3	3	6	3	4

Table 1: V.A. Iadov's logical chart to measure irregularities in the international legal field related to human rights. Source: Prepared by V.A. Iadov

The number resulting from the interrelation of the three questions indicates the position of each respondent in the satisfaction scale, that is, their individual satisfaction. This satisfaction scale is expressed by SVN numbers. The original definition of truth value in neutrosophic logic is shown below [7].

Let N = {(T,I,F): T,I,F ⊆ [0,1]} n, a neutrosophic valuation is a mapping of a group of propositional formulas to N, and for each sentence p we have:

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

In order to facilitate practical application to decision-making and engineering problems, a proposal was made for single-value neutrosophic sets [7] (SVNS), which allow the use of linguistic variables [8], thus increasing interpretability in recommendation models and the use of indetermination.

Let X be a universe of discourse. An S VNS A on X is an object of form.

$$A = \{\langle x, u_A(x), r_A(x), v_A(x)\rangle : x \in X\}d \quad (2)$$

Where:

$uA(x)$: $X \rightarrow [0,1]$, $rA(x)$: $X \rightarrow [0,1]$ y $vA(x)$: $X \rightarrow [0,1]$, con $0 \leq uA(x) + rA(x) + vA(x) : \leq 3$ for all $x \in X$.

The interval (x), $r(x)$ and $vA(x)$ represents the membership to true, indeterminate and false of x in A, respectively. An SVN number, to measure whether irregularities in the international legal sphere relating to human rights affect migrant workers in Ecuador, in this study is expressed as $A = (a, b, c)$, where $a, b, c \in [0.1]$, and $+ b + c + \leq 3$. The obtained SVN numbersare useful for recommendation systems.

In order to analyze the results, a scoring function is established. An adapted scoring function [9] is used to sort the alternatives:

$$s(V) = T - F - I \quad (3)$$

If the evaluation corresponds to indetermination (not defined) (I), a de-neutrosification process was developed as proposed by Salmerona and Smarandache [10]. In this case, $I \in [-1,1]$. Finally, we worked with the average of the extreme values $I \in [0.1]$ to obtain a single value.

$$\lambda([b_1, b_2] = (b_1, b_2)/2 \quad (4)$$

This proposal fills a gap in the literature of Iadov's techniques, extending it to deal with indeterminacy and the importance of the user due to experience or any other reason [6].

Based on the above, the individual satisfaction scale shown in table 2 was used to measure the individual satisfaction of each respondent.

Expression	SVN Number	Score
Clear Satisfaction	(1, 0, 0)	1
More satisfied than dissatisfied	(1, 0.25, 0.25)	0.5
Not defined	I	0
More dissatisfied than satisfied	(0.25, 0.25, 1)	-0.5
Clear dissatisfaction	(0,0,1)	-1
Contradictory	(1,0,1)	0

Table 2. Individual satisfaction scale. Source: [4].

3 Results

In the light of the regulations that have been analyzed in this study, it is pertinent to refer now to another reality and that is decent work. As we know, those who are in an irregular situation are those who are attracting our attention as a matter of priority at the moment, and it is important to analyze whether decent employment can be obtained given the circumstances as they are, both normatively and factually.

There are four parameters necessary to consider that a job is developed under the concept of "decent": "the respect and promotion of fundamental rights at work, collective rights, social protection and social dialogue" as it refers, to which is added that the indicator of decent work is undoubtedly compliance with the principle of equality and non-discrimination at work. It is analyzed that the notion of decent work itself involves several issues that need attention at this point in the research. As has been shown, this issue relates to other established rights, such as the right to dignity.

In relation to this right it is pointed out that with respect to this concept of social dignity it is based on the conception of collective solidarity "by virtue of which it is understood that every human being is framed in a society whose members are united by relations of mutual dependence and responsibilities" [10, 11]. added to this it is possible to say that this type of rights must respond to the needs and interests of all social groups and in addition to pay special attention to the most vulnerable. Thus, the ILO's purpose is not only to create a job but also to guarantee the quality of that job.

At the same time "decent work also means sufficient work (...) everyone should have access to opportunities to acquire income" [12] so in the normative field the notion of this type of principles should be focused on the coexistence of all the conditions that "guarantee the effective compliance with labour standards" [12]. The reality of migrant workers in an irregular situation is observed. On the other hand, it is emphasized that the notions of decent work in the field of migration are aimed at the fact that this is a principle whose attainment is difficult to achieve in the social legal landscape that characterizes migrant workers and migrant women in particular.

The result of applying the IADOV technique to the criteria used in the survey to measure whether irregularities in international human rights law affect migrant workers in Ecuador is shown in table 3.

Expression	Total	%
Clear Satisfaction	15	68.18
More satisfied than dissatisfied	7	30.4
Not defined	0	0
More dissatisfied than satisfied	0	0
Clear dissatisfaction	0	0
Contradictory	0	0

Table 3: Results of the application of the IADOV technique to measure whether irregularities in the international legal sphere relating to human rights affect migrant workers in Ecuador. Source: Prepared by the authors

The score is calculated and Iadov's calculation is determined, for our case study a value was assigned in the vector of equal weights $w_1 = w_2 = \cdots = w_i = 0.0456$. The final result of the method is ISG =0.841, showing that there is an effect on the human rights of migrant workers in Ecuador.

Conclusion

The normative contemplation of fundamental rights asserts that the only way to achieve equality among all migrant workers remains to open the way for unrestricted migration, an issue that allows decent work for migrant workers in an irregular situation and which could be addressed in the next proposed Global Compact on Migration, as we have seen by the ILO.

The process of measuring irregularities in the international legal sphere of migrant workers in Ecuador, carried out using Iadov neutrosophic technique, quantitatively expressed a high index of affectation in terms of the human rights of migrant workers in that country.

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Received: January 7, 2019. Accepted: May 11, 2019

Neutrosophic model for the analysis of administrative offences on sexual abuse in the ecuadorian educational system

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Abstract. The objective of this study is to analyze administrative infractions of sexual connotation, in order that the power of the state resolves to provide appropriate review resources to reduce cases of sexual abuse in Ecuador and particularly in the education system. Given that the administrative summaries issued by the Ministry of Education only review and affirm that each and every one of the administrative processes of sexual connotation show errors of fact and law in their resolutions, arguments that are supported by the establishment of District Conflict Resolution Boards that are not in disregard, in that they do not specify or single out specific cases. In order to achieve this objective, a neutrosophic model is proposed that helps to recommend which are the administrative infractions of sexual connotation in the Ecuadorian educational system.

Keywords: Administrative infractions, discretionary review appeal, sexual abuse, District Conflict Resolution Boards, neutrosophic model

1 Introduction

Sexual abuse and statutory rape are serious forms of abuse. It involves the imposition of a sexualized activity in which the offender obtains a gratuity, i.e., it is an intentional imposition based on a power relationship. This imposition can be exercised through physical force, blackmail, threat, seduction, intimidation, deception, the use of trust, affection or any other form of psychological pressure or manipulation [1].

[2] Refers that, although there are different definitions of sexual abuse, all of them identify the following common factors:

- Relationship of inequality or asymmetry of power between the aggressor and the aggressor, whether by maturity, age, rank, hierarchy, etc.
- Use of the assaulted person as a sexual object, involving him/her in sexual activities of any kind.
- Coercive maneuvers on the part of the aggressor, seduction, manipulation and/or threats.

Sexual abuse involves conduct of any sexual type that is performed, to deal with situations of mistreatment, harassment, sexual abuse or statutory rape in educational institutions, such institutions must act promptly in situations of mistreatment, harassment, sexual abuse or statutory rape, detect a situation of mistreatment, harassment, sexual abuse or statutory rape implies that an adult in the educational community becomes aware or suspects that a student is being harmed by the action or omission of another person, whether or not that person is a family member [1].

The aforementioned author refers that it is not the function of educational professionals to investigate or diagnose these situations, but to be alert and act in a timely manner, referring to specialized centers and making complaints in the event of mistreatment or sexual abuse. Based on the foregoing, the product of Higher Education includes the constant evaluation and reformulation of each process and is not limited to judging the delineation and distribution of curricula or to ascertaining whether or not the resources involved are sufficient[3].

In this sense, the discretionality of the review resource in administrative infractions is understood as the power of the public power to act on its administered, in merit of a subjective assessment, but outside the law. With regard to the remedy of review, which corresponds to the provision to activate by ministerial agreement, for cases of administrative infractions with a sexual connotation in the Ecuadorian educational system, assessments relating to whether or not compliance with

its conception was carried out, in order to obtain clarification and substantiation of the reason for this decision and not another in a general manner, for each specific case [4].

2 Development

In Ecuador there have been numerous judicial and administrative actions aimed at clarifying acts of corruption and responding to Ecuador's social outcry, as a result of multiple cases of sexual connotation that were known and forgotten and, in many cases, resolved in an unsatisfactory manner by the Ecuadorian authorities. In this sense, a supposed support to the affected citizens was manifested, having the same ministerial agreements given the origin of revision of all the processes of sexual connotation that did not end in destitution and sanctions.

It also points out that the decision related to the foregoing had an effect on the ministerial agreements issued by the Ministry of Education. This action corresponds to the social upheaval produced by the cases of sexual connotation detected at the level of the national education system, but in reality, neither the error of fact nor the error of law to which they allude in their substantiation are established in the literal or subjective content of the administrative acts they carried out.

In accordance with the foregoing and with regard to the effects of the ministerial agreements issued by the Ministry of Education, it is determined that the protection of students is an objective that must be achieved through the articulation of the various management instruments available to each institution. Through the diversity of tools [5].

Educational institutions have the opportunity to propose different types of actions that are consistent with this objective since, according to [6], the factors or experiences to which students are exposed in the classroom may or may not be harmonized with the natural systems of learning and memory of the brain, which will directly reflect on the development of brain potential. Thus, for example, in accordance with the School Coexistence Policy, it is necessary for each institution to construct a coexistence regulation that ensures the right to education for all students; a right that is explicitly found in this policy [7]. This regulation protects the entrance and the permanence of the students in the establishment, through the construction of norms that make clear what is expected of each member of the school community, what will be considered unacceptable, and the formative measures that will be applied to those who do not respect these indications.

The aforementioned author quotes that the reasons referred to above are not proven with clarity or precision, the statements to be understood by administrative means do not have the will to clarify this type of facts, the personnel are not adequate since they do not have sufficient expertise, nor the adequate means to guarantee adequate scientific-technical work.

On the other hand, the Ecuadorian educational system has a coexistence manual; in the manual, there are duties and rights that must be fulfilled by each student, the role that teachers play in certain institutions, and the role of the representative or parent. By allowing a normative instrument to prevent violence, harassment, bullying or school harassment, providing the teachers with the information they need, elements that help the educational community to apply the corresponding Law [8].

There are sanctions for each teacher's misconduct according to its severity and in accordance with the code of cohabitation the admonitions can be verbal or written, between the most serious offense is to commit sexual violence, abuse, or other sexual crimes.

According to Art. 354 chapter XI of the infractions of sexual connotation, it refers that:

For the purposes of disciplinary punishment, sexual harassment or harassment in education, without prejudice to the provisions of the Criminal Code and the Childhood and Adolescence Code, means any conduct with a sexual content that is carried out in isolation or repeatedly, in writing or verbally, gesturally or physically. The following conduct or manifestations are considered for this purpose:

1. A requirement of sexual favors involving the offer, by a teacher, manager or administrative, aimed at improving the academic status of a student in exchange for any favor of a sexual nature;
2. Implicit or express threats, physical or moral, of damages and punishments, referring to the current or future situation of the student, which could be avoided if favors of a sexual nature were granted;
3. Use of written or oral words of a sexual nature or connotation, directed at one or more students in a specific or individual manner;
4. Displaying sexually oriented images, constant in pictures, movies, magazines, or other media that depart from the educational purpose;
5. Displaying pornographic images, constants in pictures, movies, magazines, or other media;
6. Making gestures, gestures, or any other nonverbal conduct of a sexual nature or connotation; and,
7. Body approaches and other physical contacts of a sexual nature or connotation".

The article in question states that sexual harassment in education is any conduct or sexual act that is carried out in written, verbal, gestural or written form. And article 355 of the Organic Law of Intersectoral Education states that:

"Art. 355.- Duty to denounce. Any authority or director of an educational establishment, teacher or administrative staff, student or any other person who has knowledge of any act of sexual harassment or harassment to the detriment of one or

more students, shall have the obligation to report the alleged harasser to the District Dispute Resolution Board. Failure to comply with this provision shall be considered as serious misconduct and shall be subject to the sanctions provided for in these Regulations".

According to art. 355, which indicates that any person or authority of the educational establishment, who knows that there is some act or sexual harassment that harms one or more students, will have the obligation and the power to report to the District Board of Dispute Resolution.

Based on the analysis carried out by [6], it is stated that there are mistakes in pretending that all the processes denounced are considered suitable for imposing a sanction, which is none other than the separation of this work activity for teachers.

On the other hand, and considering that the process for the review appeal is based on the decisions of the Education zonal coordinations brought to the attention of the Ministry of Education, where the admission of the Extraordinary Review Appeal is accepted in order to dictate measures of protection against the accused, without taking into account that the measures supposedly were established to guarantee the removal of the alleged victims.

It is also considered in the analysis that at the beginning of the administrative summary, according to [9], where it alludes that the measures adopted were dictated and produced separation from the teaching student, which is unnecessary, since the only thing that is achieved is to stigmatize the teacher since he is in a new place of work trying to re-establish his labor activity and even more so when this teacher for obvious reasons was found without responsibility for what he was accused of.

Therefore, it is considered necessary to make it clear that all those teachers who were initiated the review process are those who, within the development of the Administrative Summaries instituted against them, was found not responsible for the acts of which they were accused and the only objective for them is to expel them from their work .[9]

With regard to the above-mentioned considerations and the fact that the education authorities in the city of Quito are carrying out, on a massive scale and in folders, the administrative summaries for the period 2014 to 2017, which were known in their own jurisdiction, in order to be investigated and prosecuted. On the other hand, it refers that the Quito education authorities studied different files on cases of sexual violence in educational institutions in that district and submitted them to the Attorney General's Office for judicial investigation. Those involved in these cases were separated from the educational entities, an action that is added to the documents already submitted by the Minister of Education.

However, the reality is that this has transcended to the rest of the country and has allowed the inclusion of many of the cases without having been charged in the criminal system, highlighting the following factors related to the recourse to review in administrative infractions of sexual connotation in the Ecuadorian educational system.

1. It is reported that with the dismissal of teachers who were involved in the administrative processes of sexual connotation, that is to say that there was no certainty that they were guilty of what they were accused of and even so, they were dismissed.
2. It is not possible to exonerate teachers who have already been placed in other educational units where they could develop normally and without any social prejudice because of the accusation made against them, since they are again separated from the new educational establishment and a clear and proven assumption is stigmatized that the responsibility that was denounced did not exist.
3. The families of the persons summarized again by the same process are again emotionally charged because having already determined that there was no responsibility and having in their clear knowledge the idea that this was a forgotten matter, now again a process appears in which the opposite is said, leaving the reputation of the summarized person in between, generating labor instability.

Based on an analysis of the factors related to the appeal for review of administrative offences with a sexual connotation in the Ecuadorian education system, there is a need for the State's decision, when issuing ministerial agreements, to initiate appeals for review of summaries in the education sector, which renders ineffective the administrative action taken, in order to provide for sanctions to be taken in a manner different from those previously sanctioned, through the integrated development of an already systematized process with a minimum guarantee.

The above-mentioned filing contributes to the fact that no severe sanctions are imposed and that sanctions are only imposed on the basis of what has been denounced. Essentially, denouncing an act of sexual connotation is equivalent to separating a teacher from his or her work, thereby putting an end to his or her career, leaving no room for doubt that what was denounced may not be entirely true, hence the fact that we must also consider that there is never 100% certainty in cases in which an act is denounced.

From a methodological and practical point of view, there is no evidence of teaching resources that would promote individual and social development, capable of fostering independence and creation . Consistent with the above-mentioned considerations, it is important to develop a neutrosophic model for the analysis of administrative infractions on sexual abuse in the Ecuadorian education system, given that in these cases there are countless linguistic terms, which constitute a set of terms obtained from the documentary analysis of educational processes in each education system.

According to the above, the sets of terms are composed of ideas, intuitions, for that reason to treat these sets is made use of neutrosophy and in particular the neutrosophic sets, which generalize the diffuse set (especially the diffuse and intuitionist set), as well as the set for consistent and the intuitive set. Neutrosophy was proposed by Smarandache[10] for

the treatment of neutrality. It has formed the basis for a series of mathematical theories that generalize classical and diffuse theories such as neutrosophic sets and neutrosophic logic [11].

With the purpose of facilitating practical application to problems of decision-making and engineering, the proposal was made the single-value neutrosophic sets [10] (SVNS) which allow the use of linguistic variable [12] which increases the interpretability in recommendation models and the use of indetermination.

In view of the above, this study makes use of neutrosophy to recommend which are the administrative infractions to address the sexual connotation in the Ecuadorian educational system.

3 Materials and methods

Documentary analysis was carried out, in particular of the informative materials in order to know information that was contrasted with the regulations exposed within the introduction and the doctrinal contributions inherent in explaining the concept of the Constitution, neo-constitutionalism and guaranteeism. The process was carried out by means of qualitative research techniques that allow the systematized and specific study of the procedural pieces detailed above, losing us the sense to carry out a study in a determined space and applicable to our present time since the facts submitted to study took place in our country equator, specifically in the province of Pichincha, canton Quito, and in the resort of the present year.

The analytical method was applied to arrive at a result through the decomposition of a phenomenon in its constitutive elements, taking into account that there are multiple and very diverse species of analysis, which are indicated by the nature of the analyzed. Also, the grammatical method was employed since it allows to establish the senses and scope of the law making use of the tenor of the own words of the law, that is to say, to the meaning of the terms and phrases that the legislator used to express and to communicate his thought. This method concentrates on paying attention to the way in which the legal disposition was written by the legislator, that is to say, to analyze through the grammatical and language rules to find meaning to what is mentioned there, to simply analyze the expressions. Let's remember that the legislator by obligation should write a law so that any citizen could interpret it. Consequently, it will be used to look for meaning from what, grammatically expressed in the Constitution, in relation to executive decrees and administrative acts, so that it allows us to understand the scope and limits set in their conception and the laws that must be respected, with absolute subjection.

In addition, use was made of the axiological method, since Juridical Axiology, which is also known as Theory of Just Right, is a part of Juridical Philosophy that seeks to discover the values in which the Positive Juridical Order must be inspired, elucidating a model that will prevail, a smooth Theory of Justice. In this sense, Axiology is the science that deals with values. The Philosophy of Law, as the foundation of its existence, has a double purpose: to investigate the origins of law in search of the most adequate concept, as well as in relation to its values. The latter includes the Juridical Axiology, dedicated to dealing with the valuation purposes of law, finding them, analyzing them, qualifying them and even hierarchizing them. Consequently, the application of this method will explain the values that the Constitution of the Republic of Ecuador truly developed in reality and the purpose that it had for executive decrees to be carried out.

According to the results obtained when applying the above-mentioned methods, neutrosophy is used for the analysis of the linguistic terms obtained and related to administrative infractions on sexual abuse in the Ecuadorian educational system. In particular, a model based on the aggregation of information was used.

Aggregation of information is the fusion of information and consists of the process of combining different data to provide a single output. Aggregation operators are a type of mathematical function used for the purpose of merging information. They combine n values in a domain D and return a value in that same domain [13].

The workflow is proposed in Figure 1.

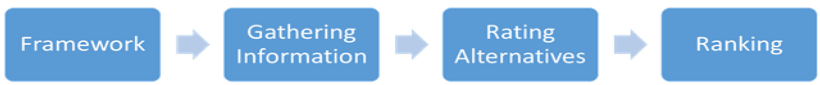

Fig. 1. Model based on the aggregation of information for the analysis of administrative infractions on sexual abuse in the Ecuadorian education system. Source: Prepared by the authors.

To obtain results, linguistic terms and indetermination are used using single-value neutrosophic numbers (SVNs) [8, 9], based on the aggregation of information. SVNs is expressed as $A = (a, b, c)$, which are represented by tuples. For this reason, this study takes into account the set of linguistic terms, defined by , which are shown in Table 1.

Linguistic term	SVN Numbers
Extremely good(EG)	**(1,0,0)**
Very very good (VVG)	**(0.9, 0.1, 0.1)**
Very good (VG)	**(0.8,0,15,0.20)**
Good(G)	**(0.70,0.25,0.30)**
Medium good (MDG)	**(0.60,0.35,0.40)**
Average(M)	**(0.50,0.50,0.50)**
Medium Bad (MDB)	**(0.40,0.65,0.60)**
Bad (B)	**(0.30,0.75,0.70)**
Very bad (VB)	**(0.20,0.85,0.80)**
Very very bad (VVB)	**(0.10,0.90,0.90)**
Extremely bad (EB)	**(0,1,1)**

Table 1: Linguistic terms used [18].

The detailed description of each activity in the proposed model (figure 1) for the analysis of administrative infractions on sexual abuse in the Ecuadorian education system is presented below.

1. Establish evaluation framework

The criteria and alternatives to be evaluated are selected in order to prioritize the latter. The framework is defined as follows:

$C=\{c_1,c_2,...,c_n\}$ with $n\geq 2$, a set of criteria

$E=\{e_1,e_2,...,e_k\}$ with $k\geq 1$, a set of experts

$X=\{x_1,x_2,...,x_m\}$ with $m\geq 2$, a finite set of alternatives

2. Gathering information

At this stage, information is obtained on the preferences of decision-makers. The utility vector [80] is represented as follows:

$Pj=\{p_{j1},p_{j2},...,p_{jk}\}$, where p_{jk} is the preference in relation to the criterion c_k of the alternative x_j

3. Rating alternatives

In order to evaluate the alternatives, the alternative where the aggregation operators are used is constructed.

4. Ranking

At this stage the alternatives are classified and the most convenient is chosen by the scoring function [81, 82]. According to the scoring and precision functions for SVN-sets, a ranking order of the set of alternatives can be generated [83]. Select the option(s) with higher scores.

A scoring function defined by [14] is used to sort alternatives:

$s(Vj)=2+Tj-Fj-Ij$ (1)

In addition, the precision function is defined as follows:

$a(Vj)=Tj-Fj$ (2)

and then:

If $s(Vj) < s(Vi)$, then Vj is less than Vi, denoted as $Vj < Vi$

In case of $s(Vj)= s(Vi)$

If $a(Vj) < a(Vi)$, then Vj is minor Vi, denoted by $Vj < Vi$

If $a(Vj)= a(Vi)$, then Vj and Vi are equal, denoted by $Vj= Vi$

The ranking is carried out according to the scoring function of the evaluated alternatives.

4 Results

The first result of our investigation is that definitively the conception of the ministerial agreement infers in a negative way since it is applied only in those processes in which there was no sanction with dismissal, but not in the other processes.

The issuance of the ministerial agreement in strict adherence to the Ecuadorian constitutional conception, is that it must be used, when the decision of the public authority is needed, by an imperious need of control of administration, organization or regulation, but not to the clamor of a social sector and for its own benefit.

As a third result of our investigation, we have that the admission order of these review resources is based solely and exclusively on a general error of fact and law that was never individualized and motivated for each specific case.

According to the results obtained, the neutrosophic model based on ideal distance is applied for the analysis of administrative infractions on sexual abuse in the Ecuadorian educational system. For our case study, the evaluation framework is composed of an expert who evaluates 3 alternatives, which are the factors related to the appeal for review in administrative infractions of sexual connotation in the Ecuadorian educational system.

x1: Removal of teachers who were involved in administrative processes of sexual connotation

x2: Stigmatization of clear and proven assumptions of the non-existence of reporting responsibilities

x3: Emotional burdens of the families of people repeatedly summarized by the same process that generates job instability.

The criteria to be considered for the evaluation of the 3 alternatives referred to above are:

c1: Point of view

c2: Perspective

c3: Psychological affectation

The linguistic terms shown in Table 1 are used for the evaluation. Once the evaluation framework has been established, the information is collected and the results are shown in Table 2.

	x1	**x2**	**x3**
c1	MDG	EG	MG
c2	G	MDG	B
c3	MDG	MDG	G

Table 2: Results of the collection of information

The vector used for our case study has the following weights: W = (0.58,0.28,0.20). The opinions of the decision-makers are then aggregated using the SVNWA aggregation operator, the result is shown in table 3.

	Agregación	**Scoring**	**Ranking**
x1	(0.53, 0.4, 0.56)	1.83	2
x2	(0.43, 0.0, 0.0)	2.53	1
x3	(0.66, 0.52, 0.63)	1.72	3

Table 3: Results for the evaluation

According to the scoring function, the alternatives are ordered as follows: $x2 \succ x1 \succ x3$, which means that there is a stigmatization of clear and proven assumptions of the non-existence of reporting responsibilities, which affects the dismissal of teachers who were immersed in the administrative processes of sexual connotation and all of this leads to the existence of emotional burdens of the families of people repeatedly summarized by the same process.

An analysis was also made of the novel aspects contributed in the present investigation, highlighting that the ministerial agreement and all administrative acts emanating from it, in the public sector in charge of knowing and processing the appeal for review, are carried out under the general protection of the provisions, but not in form or in substance, respecting the basic guarantees of due process that being a right to be considered in a fundamental way in any judicial or administrative process.

What derives from the ministerial agreement and all the administrative acts that make it impossible for lawyers to carry out technical defense, reduced in terms of possibilities of obtaining a favorable resolution, refers to the fact that there is no guideline other than that of the sanction with dismissal.

As a consequence of the above-mentioned results, the discretionality with which the executive decree provides

for initiating the review process clearly indicates that the tendency is only sanctioning and does not look at the opposition that should exist for people who could have been harmed by the bad actions of the public administration; what technically, does not fit within the discretionality of regulated powers nor discretionary powers, since in essence, it fits the norm but it does not have subjective background that supports correctly its conception, that if we look at it and focus from the constitutional point of view, should be tending to the protection of rights, but not to the detriment of the same ones when not observing the process that must be given to each citizen.

Conclusions

It is noted that the inference of the ministerial agreement on administrative decisions in the education sector is not correct, given that only those teachers who have not been sanctioned with dismissal have been sought to initiate appeals for review and, on the contrary, the resolutions that separated other teachers have not been reviewed in order to clarify the commission of certain acts or the nonobservance of certain norms.

The admission orders of the extraordinary review appeals issued by the Ministry of Education, in cases of administrative summaries with sexual connotation are based solely and exclusively on an alleged error of fact and of law in a general sense, but it is never specifically identified which is for each case what makes it a resolution without motivation.

With the neutrosophic model based on ideal distance for the analysis of administrative infractions on sexual abuse in the Ecuadorian educational system, it was confirmed that there is a stigmatization of clear and proven assumptions of the non-existence of denunciation responsibilities, which affects the dismissal of teachers who were immersed in the administrative processes of sexual connotation and all of this leads to the existence of emotional burdens of families, of persons repeatedly summarized by the same process.

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Received: January 17, 2019. Accepted: May 9, 2019

Use of neutrosophy for the analysis of the social reintegration factors of released prisoners in Ecuador

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Abstract. The research was aimed at determining the relationship between penitentiary policy and the social reintegration of those released from the Santo Domingo de los Tsáchilas penitentiary in Santo Domingo Canton, in 2017, through non-experimental and correlational research. A sample of 20 released persons was considered, and for the collection of information regarding the two variables, a structured survey was applied, as well as interviews with social groups. A recommendation model based on knowledge was used, using neutrosophic sets of unique value, revealing from the results obtained the main organizational and legal factors of Penitentiary Policies and the Social Reinsertion of those released from Santo Domingo de los Tsáchilas in 2017. On the basis of these factors, a recommendation is made to favor the reinsertion of prisoners into society.

Keywords: Social work, reintegration, prisoner, penitentiary system, prison, neutrosophic statistics

1 Introduction

In today's world, the fight against criminality is becoming more and more complex, crime levels are increasing in a worrying way, and citizens are demanding greater security from their leaders. Today, there is no political and governmental agenda that does not include public security among its objectives [1], in order to minimize the effects of crime on societies.

The term reinsertion is mainly used as the action of integrating again into society or community that individual deprived of liberty towards productive activities that the person exercised before the entrance to prison through programs and intervention strategies from inside the prison to facilitate the reinsertion or reincorporation of the persons to their family and society. For this reason, it is stipulated that it is an act of giving the offender the opportunity to adapt again or adapt positively to society.[2]

They warn that the design and planning of activities that contribute to increasing levels of social participation are characterized by formality and verticalism, where participation is organized from bottom to bottom, with their backs to the interests and needs of the group, thus limiting their reflexive and active involvement in the community environment. This entails the risk that people assume a passive role and a lack of social commitment, even in those issues that affect them, thus limiting their protagonism in social development, at least from formal spaces [3].

They analyze psychosocial treatment from an interdisciplinary approach in order to extract and reflexively recover the experiences of the process from the perspective of social work, concluding that overcrowding limits the process of resocialization of the prisoner, the deficiencies of infrastructure and services to carry out prison work, and psychological therapies contribute to the low prognosis of rehabilitation [4].

They assess the extent to which occupational training and work programmes in prisons in Catalonia contribute to the social and labor reinsertion of prisoners and ex-prisoners, stressing that occupational training and workshop work contribute moderately to the reinsertion of prisoners, according to their personal motivation and social resources; however, their most determining role lies in their therapeutic and educational aspects in the prison itself, which helps to maintain order and, indirectly, to the resocialization of prisoners [5].

They describe social reintegration as an international model of crime prevention that is not based on a criminal law that seeks to punish the person himself, but rather seeks to punish the criminal act and reintegrate the person into the society that aggravated his conduct, to do so, it must receive prison treatment under the principles of respect for human rights through work, training for work, education, sport and health [6], because initial education (...) plays a crucial role in the quality of education, as well as the fact that it continues in continuous education and training .[7]

Despite the fact that the social reintegration of inmates is a mandatory subject within the Mexican penitentiary system, the reality of prisons in Mexico presents multiple problems for the achievement of this process. The studies carried out by [8] in the prisons of Topo Chico, Cadereyta and Apodaca show that the majority of male inmates of productive age, after their imprisonment, are not guaranteed either training or sufficient education to ensure a decent working future. Therefore, they suggest organizing education, health, training and paid employment programs, with greater success, since they would serve as the basis for reducing crime.

All the efforts made can be lost due to the lack of orientation that the community has in order to give continuity to the process initiated in reclusion. In Cuba, advanced Pedagogy and Psychology programs are being applied to give differentiated educational treatment to young people based on the special conditions in which they comply with their sanctions. Once they graduate from correctional institutions and rejoin society, in order to act in social reintegration [9], they present a system of activities to be carried out by community agents and factors, based on the incorporation of sport, culture, education and work, among others, corroborating the effectiveness of the same, which allowed for raising the rates of reinsertion of young people and providing community agents with an instrument for action in accordance with the objectives set.

These results are reinforced by [10], who describes the Cuban experience in community social control that can be a reference for other countries engaged in the fight against criminality and the consequent citizen insecurity through the work of popular organizations, a systematic work of education, awareness-raising and sensitization of the population, which is ultimately decisive for this control activity in the socio-community environment, together with the convening power of the Cuban state, as a consequence, in addition, of the confidence that the people have maintained in the revolutionary government.

They describe a co-administrative and participative business model to encourage the economic and social reinsertion with values of the inmates of the penal establishment of Picsi, Peru. The program is based on previous knowledge and values in order to fully develop the capabilities and productivity of the inmates, and involves the entire family so that family values are transformed or strengthened - as appropriate - as part of the process of social, economic and labor reinsertion of the prisoner and promote training, credit and formation of microenterprises, to improve their quality of life and not relapse into delinquency. It concludes that strengthening values such as honesty, responsibility, perseverance, trust and teamwork, among others, empowers productive units, reduces project abandonment and reinforces the social, labor and economic reintegration process of inmates of the Picsi Criminal Establishment [11].

They present good practices of training and labor insertion in the international environment that emphasize the need for personalized attention, with educational accompaniment and work to build a social network of support through social awareness actions that allow second opportunities for ex-prisoners.

The development of criminal trajectories in a territory cannot be tackled only through psychological or educational treatment as usual. Rather, the prevention of infractions requires different levels of intervention, the psychosocial and community approach being fundamental.

The current Constitution of the Republic of Ecuador establishes a social rehabilitation system for the purpose of the comprehensive rehabilitation of persons sentenced to criminal penalties in order to reintegrate them into society, as well as the protection of persons deprived of their liberty and the guarantee of their rights. The system prioritizes the development of the capacities of persons convicted of crimes to exercise their rights and fulfill their responsibilities when they are released.[12]

The Comprehensive Organic Penal Code establishes the National Social Rehabilitation System in Ecuador as a set of principles, norms, policies of institutions, programs and processes that interrelate and interact in a comprehensive manner for criminal execution.

However, for society, the State has not achieved the conquest of this sector, so it is not possible to speak of the rehabilitation of the individual, despite the fact that the constitution indicates that persons deprived of liberty are considered a vulnerable group with priority attention. In practice, there is no real rehabilitation, since many of the persons deprived of their liberty are repeat offenders and even go out with other modalities, such as entering through the sale of drugs and going out to engage in the theft of persons. It is necessary to emphasize that there may be rehabilitation, but if there are no sources of work outside the Centers of Deprivation of Liberty, it would result in that person again committing a crime. "[...] the supreme corrective to natural crime, reincorporation justly in knowledge, respect and preservation in formal terms." [12].

The person deprived of liberty, once he serves his sentence, recovers his liberty, recovers this very basic principle; it could be said that his free will is rehabilitated, freedom makes us possessors of negative and positive decisions, for an ex-prisoner it would be the freedom to decide to infringe the Law again and to submit again to a sanction of personal precautionary measure that restricts his freedom again; or otherwise, the ex-prisoner could take the decision to reinsert himself into society as a rehabilitated and productive individual.

There is a duality in the way the prison sentence is viewed: a) from the perspective of a society that demands greater security and that only in the imposition of sentences deprived of liberty does it satisfy its demands for justice and social peace; b) from the point of view of persons deprived of liberty, who, the longer they are detained, have less chance of returning to society as a member who will not offend again, since mere deprivation of liberty

has not only proved to be ineffective in the fight against the increase in delinquency, but also, according to official figures on recidivism, seems to stimulate it.

Statistics show that prisons have become overcrowded and that Ecuador's current penitentiary system does not comply with the fundamental objectives of the Constitution and does not consider the person deprived of liberty as a vulnerable and priority group.

All of the above leads us to study the process of social reintegration of former inmates of the Santo Domingo de los Tsáchilas Liberty Deprivation Center, Santo Domingo Canton in Ecuador, in order to determine the relationship between penitentiary policy and social reintegration during the year 2017. The study made use of knowledge-based recommendation models, which make suggestions by inferring the user's needs and preferences . The knowledge-based approach is distinguished in the sense that it uses knowledge about how a particular object can meet the user's needs, and therefore has the ability to reason about the relationship between a need and the possible recommendation that will be displayed. In this study, the recommendation model is based on the construction of user profiles as a knowledge structure that supports inference which can be enriched with the use of expressions that use natural language [13]. [14]

This paper proposes a recommendation model based on knowledge using neutrosophic numbers of unique value (SVN) allowing the use of linguistic variables [14] to recommend the factors to be taken into account in the social reinsertion of released prisoners in Ecuador. This process is considered as modeling, taking into account that it is articulated from sequences that are instituted in the representation of an internal character.

2 Materials and Methods

A descriptive study is conducted to analyze and interpret the topic in the case study through the non-experimental cross-sectional design.

Theoretical methods were used through structured survey techniques and interviews through dialogue with different social groups in the Canton of Santo Domingo to identify citizen criteria on the subject of study supported on the basis of what is required by legal regulations.

Documentary review to verify the role of the state, its constitutional and legislative policy in force through social reinsertion.

The sample consisted of 20 released from the Santo Domingo Penitentiary Establishment of the Tsáchilas of the Santo Domingo Canton, who at all times offered their collaboration for its realization.

A recommendation model based on knowledge was developed using neutrosophic numbers of unique value, to recommend the analysis of the main organizational and legal factors of the Penitentiary Policies and the Social Reinsertion of the released penitentiaries in Ecuador. Neutrosophy is a new branch of philosophy which studies the origin, nature and scope of neutrality, as well as its interactions with different ideational spectra, created by Professor Florentin Smarandache[15]. His fundamental theory states that every idea tends to be neutralized, diminished, balanced by ideas as a state of equilibrium.

The term "neutrosophic" was proposed because "neutrosophic" comes etymologically from "neutrosophy", which means knowledge of neutral thought, and this third neutral represents the main distinction, i.e. the unknown indeterminate neutral part (in addition to the "truth" "belonging" and "falsehood" Components of "nonbelonging" that appear in the overall fuzzy logic). Neutrosophic Logic is a generalization of Zadeh's fuzzy logic[16], and especially of Atanassov's [14] intuitive fuzzy logic and other logic.

The workflow of the knowledge-based recommendation model using single-value neutrosophic numbers for the analysis of the social reintegration factors of released prisoners in Ecuador is presented in Figure 1. The model is based on the proposal of for knowledge-based recommendation systems allowing linguistic terms and indetermination to be represented by single-value neutrosophic sets (SVN), [17].

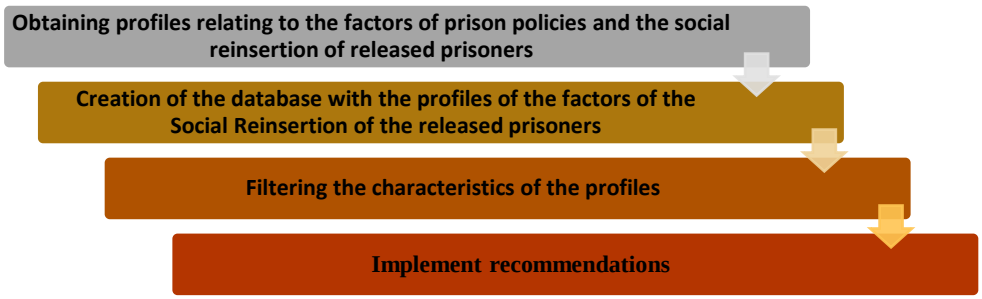

Figure 1: Proposed model. Source: Own elaboration.

The detailed description of each of the components of the model supported by the proposal is presented below:

1. Obtaining profiles relating to the organizational and legal factors of prison policies and the social reintegration of released prisoners.

Each of the organizational and legal factors of the Penitentiary Policies and the Social reinsertion of those released for their social reinsertion are described by a set of characteristics that will conform the profiles for analysis, these characteristics are represented by expression 1.

$$C= \{c1, \dots ,,\dots,cl\} \quad (1)$$

To obtain the database with the profiles of the organizational and legal factors of the Penitentiary Policies and the Social Reinsertion of the released prisoners for their social reinsertion are obtained through single valued neutrosophic number (SVN) [28, 29], where it is taken into account that:

Sea $A* = (A1*, A2*,\dots).An*)$ is a vector of SVN numbers such that $Aj *=(aj*, bj*, cj*)$ j=(1,2, ... , n) and $Bi = (Bi1, Bi2, \dots ,Bim)$ (i = 1,2, ... , m) are m vectors of n SVN numbers such that and $Bij = (aij, bij, cij)$ (i = 1,2, ... , m), (j = 1,2, ... , n) then the Euclidean distance is defined as. The Bi and $A*$ result [28]:

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

From the obtaining of the Euclidean distance, a similarity measure is defined as referred to in [18].

To the extent that the alternative Ai is closer to the profiles relating to the organizational and legal factors of the Penitentiary Policies and the Social reinsertion of those released for social reinsertion (si), the greater the similarity will be, which makes it possible to establish an order between alternatives according to [15]. The profiles relating to the organizational and legal factors of prison policies and the social reintegration of those released can be obtained directly from experts, which is mathematically represented by equation 3.

$$F_{a_j}=\{v_1^j,\dots,v_k^j,\dots v_l^j\},j=1,\dots n \quad (3)$$

The evaluations of the characteristics of the main organizational and legal factors of the Penitentiary Policies and the Social Reinsertion of the released prisoners for their social reinsertion are expressed using the linguistic scale S, $\in$S where S=$\{s_1,\dots,s_g\}$ corresponding to the second set of linguistic terms defined to evaluate the characteristics using the numbers SVN. For this purpose, the linguistic terms to be used are defined once the set of conceptions related to the right to life has been described and are represented according to expression 4.

$$A=\{a1,\dots,aj,\dots,an\} \quad (4)$$

The set of organizational and legal factors of the Penitentiary Policies and the Social Reinsertion of the released prisoners, for their social reinsertion, is kept in a previously created Database.

2. Creation of the database with the profiles of the organizational and legal factors of the Penitentiary Policies and the Social Reinsertion of the released prisoners.

In this phase, the database is created with the profiles of the organizational and legal factors of the Penitentiary Policies and the Social Reinsertion of the released prisoners for their social reinsertion. The factors that correspond to the profiles of released prisoners are shown mathematically through expression 5.

$$P_e=\{P_1^e,\dots,P_q^e,\dots,P_l^e\} \quad (5)$$

These profiles are made up of a set of attributes, which for interpretation are represented through expression 6.

$$C_e=\{c_1^e,\dots,c_k^e,\dots,c_l^e\} \quad (6)$$

Where; $c_k^e \in S$

The profiles corresponding to the organizational and legal factors of prison policies and the social reintegration of those released for social reintegration are obtained through the so-called conversational approach or through examples, which can be adapted as referred to[19].

3. Filtering the characteristics of the profiles

In this phase, the main organizational and legal factors of the Penitentiary Policies and the Social Reinsertion

of the released prisoners for their social reinsertion are filtered in order to find out which are the factors that influence so that the released prisoners can be incorporated into society.

In order to obtain these results, the similarity between the organizational and legal factors of the Penitentiary Policies and the Social Reinsertion of the released prisoners for their social reinsertion is calculated, the profile of each factor, Pe and each characteristic related to the factors that influence social reinsertion registered in the database is obtained through the calculation of the total similarity, using the expression 7.

$$s_i=(1-d_i)^{\frac{1}{2}} \quad (7)$$

The function *S* calculates the similarity between the values of the attributes of the profile of the organizational and legal factors of the Penitentiary Policies and the Social reinsertion of the released prisoners for their social reinsertion, *aj* [32].

The profile related to the main factors for the social reinsertion of released prisoners is obtained through the so-called conversational approach or through examples that can be adapted according to [15].

4. Implement recommendations

Calculated the similarity between the profiles of the organizational and legal factors of the Penitentiary Policies and the Social Reinsertion of the released prisoners, for their social reinsertion and each factor analyzed in the present study are ordered according to the similarity obtained, it is represented according to the similarity vector that is represented in expression 8.

$$D=(s_1,\ldots,s_n) \quad (8)$$

The characteristics to be taken care of will be those that best satisfy the needs of the profile of the organizational and legal factors of the Penitentiary Policies and the Social Reinsertion of the released prisoners, that is to say those that possess greater similarity with the characteristics of the released prisoners that desire to reincorporate to the society.

3 Results

The diagnosis showed that the facilities of the Santo Domingo de los Tsáchilas Prison are not adequate for a therapeutic and psychosocial process; even the staff of psychologists and psychiatrists is not sufficient for the 1601 persons deprived of liberty that exist in this Centre:

1.The limited opportunities for rehabilitation and the lack of efficient administrative policies in detention centers to meet the primary objective of rehabilitation set out in the Constitution.

2.The prisoners are mainly people who have not had access to basic services that the State should provide to the population, they came from broken families, with parental abandonment and instability of family members whose relationships were marked by domestic violence, such as physical and psychological abuse and negligence on the part of parents or caregivers, some have as close models siblings or groups of peers who are using drugs and breaking the law.

3.Temporal and Future Perspective of released prisoners who wish to reincorporate into society, characterized by established goals, resources and actions implemented for their concretion.

The interviews carried out show the influence that the social and economic context exerts on the elaboration of future goals and the degree of feasibility that they have with the released prisoners. In this sense, it should be noted that people in unfavorable educational and socioeconomic conditions tend to show a restricted Future Temporal Perspective, an aspect that can be explained in terms of the lower level of resources available for their maintenance and achievement.

Similarly, information was obtained regarding the work carried out in the families of released prisoners, which is non-existent, since there are no resources or professionals prepared to carry out such work. When inmates are released, the institution has no way of monitoring their reintegration, which leads to a decrease in support networks [11].

Other results obtained from interviews with social groups are that 87% of those interviewed agree that they do not offer a job opportunity to a former prisoner, due to a lack of confidence in these people to take charge of their businesses or even their families. This infers that job opportunities for a former inmate in Cantón Santo Domingo are very low if the state does not take action to reverse the fact.

Similarly, 93% say that the penitentiary system does not fulfill its purpose of rehabilitation as enshrined in the country's Constitution, it would be a center for the deprivation of liberty, these buildings do not comply with the structural logistics for an adequate rehabilitation for the inmate [4].

On the other hand, the Constitution of the Republic of Ecuador, in its art. 2003, on the guidelines of the social rehabilitation system in its fifth paragraph; ratifies social reintegration as one of the fundamental objectives of the system, so on the basis of this it is recommended to promote respect for the rights of persons deprived of liberty, since that is the objective of our Constitution, although the reality if distant from what is enshrined in the Magna Carta that guarantees a series of rights to this priority attention group, what the current legislation has sought is to

leave behind the punitive system, being repealed; Today, the State is trying to create a system for rehabilitation, since etymologically the word rehabilitation comes from the Latin word "habilitar" which means something new, seeking to train people to reintegrate into a social environment [6].

Also on the analysis carried out, it is detected that the Regulation of the National System of Social Rehabilitation in its art. 49 of this code sets forth the treatment that should be given to persons deprived of liberty, therefore this process must be attended to, which must be an orderly process, starting from individualized orientation to each person who enters a deprivation of liberty center, advancing with them towards a therapeutic part where the participation of psychologists and psychiatrists who help them to establish their correct behavior takes on great importance, in order to encourage them to continue a true process of rehabilitation by learning a trade, or a job, or even to educate themselves and obtain a degree that will help them to insert themselves into society in the future.

As described by the ex-prisoners, when they enter the center for crimes, they learn practices of violence as a means of survival and they regroup among themselves to be protected, as a solidarity among the excluded, they are marked by social exclusion, they return to the same conflictive environment, dysfunctional origin, families in conditions of instability and poverty, without access to basic services, stigmatized by society. This leads them to be marked by social exclusion, they return to the same conflictive environment, without access to basic services, stigmatized by society.

The increase in delinquency in Ecuadorian society is considered a result of the few opportunities that the State offers to its citizens, such as: a bad education system, a bad health system, there is no migration control, there are no job opportunities.

There is no monitoring and control of compliance with policies and regulations aimed primarily at rehabilitating the prisoner, for positive insertion into society; this sector has been forgotten; society is unaware of the existence of a rehabilitation policy for prisoners enshrined in the constitution; much less does society know of comprehensive rehabilitation systems for the prisoner, society only considers that prisons have become centers for perfecting offenders, in addition to considering that the existing short rehabilitation system actually causes social resentment and even hatred of justice.

The stigma of prison is an indelible effect on the life of the ex-prisoner, limiting job opportunities; the governments in office must begin to consider the reinsertion of the ex-prisoner as a social problem that afflicts society on a daily basis, and take action measures to prevent further propagation of individuals without rehabilitation who continue to delinquency; citizens must get involved to support the State and the Government in presenting projects aimed at the reintegration of the ex-prisoner.

Linguistic term	SVN Numbers
Extremely good(EG)	**(1,0,0)**
Very very good (VVG)	**(0.9, 0.1, 0.1)**
Very good (VG)	**(0.8,0,15,0.20)**
Good(G)	**(0.70,0.25,0.30)**
Medium good (MDG)	**(0.60,0.35,0.40)**
Average(M)	**(0.50,0.50,0.50)**
Medium Bad (MDB)	**(0.40,0.65,0.60)**
Bad (B)	**(0.30,0.75,0.70)**
Very bad (VB)	**(0.20,0.85,0.80)**
Very very bad (VVB)	**(0.10,0.90,0.90)**
Extremely bad (EB)	**(0,1,1)**

Table 1: Linguistic terms used by [28].

The recommendations given the information related to the 3 factors of social reinsertion of the released penitentiaries that predominate in Ecuador are shown in table 2, is obtained as shown in expression 9.

$$Pe = \{MDG, VVG, MDG\} \quad (9)$$

Based on the result obtained, it is recommended to take into account factor 2 related to the characteristics of the inmates in order to achieve their adequate reintegration into society. This is the most important factor in the analysis carried out.

Once the above-mentioned recommendation has been obtained, the similarity between the profiles of the organizational and legal factors of the Penitentiary Policies and the Social Reinsertion of the released prisoners in Ecuador is calculated. The results are shown in table 2.

$a1$	$a2$	$a3$
0.44	0.80	0.52

Table 2: Similarities between the organizational and legal factors of prison policies and the social reintegration of released prisoners Source: Prepared by the authors.

Based on the results obtained, it is recommended that attention be paid to the profiles that come closest to the organizational and legal factors of penitentiary policies and the social reintegration of those released from prison. A ranking of concepts according to comparison would be {a2, a3, a1}.

In the case of a recommendation of the profiles related to the organizational and legal factors of penitentiary policies and the social reinsertion of released prisoners, it is recommended for our case study to look at the closest profiles, which would be the recommendations, $a1$, $a3$, corresponding to the rehabilitation opportunities that released prisoners have and the temporal and future perspective that released prisoners have.

The aforementioned results help to highlight the social problem and the most vulnerable part of this problem in society. Social exclusion can be characterized as the situation of certain groups in which public and/or private mechanisms of prevention, assistance or social support do not exist or are not capable of re-establishing the balance.

Conclusions

The Penitentiary Policy, as well as the organizational factors of the penitentiary policy and the Social Reinsertion of those released from the Santo Domingo de los Tsáchilas Penitentiary Establishment of the Santo Domingo Canton, 2017, was analyzed through a recommendation model for the analysis of the social reinsertion factors of the released penitentiaries in Ecuador, the model follows a knowledge-based approach, specifically based on the use of SVN numbers to analyze linguistic terms.

It was found that persons deprived of their liberty, being a group of priority attention recognized in Article 35 of the Constitution in Ecuador, deserve better attention, in all their rights.

An analysis of the various regulations led to the conclusion that persons deprived of their liberty (Ecuadorian or foreign men and women) must have their integrity protected by the State so that their rights are not violated and thus are rehabilitated in a positive manner.

It is clear that the Ecuadorian State is solely responsible for issuing appropriate policies to develop rehabilitation systems that will lead to the prisoner's productive reintegration into society.

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Received: January 12, 2019. Accepted: May 12, 2019

Use of Neutrosophy to analyze problems related to the joint custody of children and adolescents after marriage dissolution

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Abstract. The objective of this investigation is to analyze the problems caused by the joint custody of children and adolescents after marriage dissolution. In order to do so, we used neutrosophic logic because it is useful to recommend attention to the conditions that frequently occur in this group of people. To achieve this objective, we carried out an analysis that provided scientific and legal knowledge, related to the regulation of joint custody within the Ecuadorian legal system, which had the purpose of ensuring the best interests of children and adolescents when their parents get divorced. For the study, we applied descriptive research with field design and documentary analysis; we also used interview and survey techniques whose results allowed us to determine in what percentage the rights of children and adolescents have been violated. The results analyzed through the proposed model, evidenced the need for a preliminary draft of reform to article 118 of the Code of Childhood and Adolescence regarding the joint custody after marriage dissolution, to guarantee the rights of children and adolescents. As a conclusion, we consider that it is necessary to examine the social and psychological effects on children after marriage dissolution, since during the separation process, most parents only care about their own welfare without thinking about the children's, to which is added to the application of the law to determine who keeps the children.

Keywords: joint custody, marriage bond, marriage dissolution, children and adolescents.

1 Introduction

Joint custody is defined as the physical control that parents have over their children. Custody is also defined as the act of protecting and guarding something or a person, and in this case, it would be a child. The word custody has a close relationship with the term to guard, although the last one has a more relevant meaning because it means protecting with care and diligence.

Joint custody of children and adolescents after marriage dissolution is a legal fact that takes place in society when the parents and children who make a family stop living together. That's why the judgment of a legal authority within a process in support of the causes indicated by the law, affects mainly children and adolescents. It is important to consider that the contemporary society, the mother is considered directly responsible for the upbringing of her children and, in other contexts, the mother is asked whether or not she wishes to continue with the responsibility of the education and upbringing of her children.

The mother's opinion is usually not taken into account and the fact that women face alone the responsibilities of raising and educating children is considered an obstacle for the individual and professional development of both women and children. The problem about children's custody is generated by the marriage dissolution, getting to the divorce and becoming a legal problem in the dispute over whom the children should stay with. Usually corresponding directly to the mother; it is then when the children begin to feel the absence of the father, the lack of a family. Parents' anxiety during the separation process has negative effects on children in their emotional, psychological and social development; violating the constitutional principle of the Higher Interest of the Child, the same one that states that the rights of the child must prevail over others.

When granting custody, priority is given to the divorced mother, taking into account that she must fulfill the requirements indicated by the law. In most cases, they are not asked whether they wish to go on with the upbringing and education of the children or not. Although it is a very obvious decision, many of them feel frustrated due to

the great responsibility they now have to face alone. On the other hand, the father or the other parent in most cases only has a visit regime, which makes him a visitor, so the child loses several of his/her rights by not having permanent contact with his/her other parent.

In order to carry out this investigation, the following theoretical referents were taken into account: considers that: "The word custody, which according to its etymology is derived from Latin custodia may be confused with the action of a guardian in a prison; however, within the scope of the law, the custody of children is similar to the word tutelage which, according to Cabanellas, means: "Guard, protection, defense of a right". Then, the word custody should be taken as the care, guard, protection and guardianship that parents have over children and adolescents. We should not mistake the word custody with the mere guard of things.[1]

Article 118 of the Organic Code of Childhood and Adolescence declares that, for the integral development of the family's child, the Judge will evaluate the reasons why he can entrust his care and upbringing to one of the parents; so to say, the custody, without altering the exercise of parental authority. In this same Code, parental authority is defined as follows: It is not only the set of rights but also the obligations of parents over their non-emancipated children, regarding care, education, integral development, defense of rights and guarantees of children in accordance with the Constitution of the Republic and the law.[2]

On the other hand, [2] states that: "According to Universal Law and legal norms, the custody of children is similar to the word Tuition, the right granted by the legislator to the father, mother, other ascendants or collateral, and even those who are not related to them, of a child who requires the care and protection of a certain person". It is the set of obligations and rights corresponding to certain persons indicated in the law or by the judge, regarding the personal care, upbringing, and education of the children. Considering the concepts of "custody and tuition," it is worth noticing that the most appropriate term to talk about children and adolescents after divorce is "joint custody" because it makes better reference to the care and protection of children and adolescents.

Authors such as, declare that joint custody can also be defined as an important element of parental authority and that parents have the right to be in the company of their children. [3] thinks that the custody of the child is an important issue, in search of emotional stability for the child, it is recommended that it is exercised by at least one of his/her parents and is even more appropriate if exercised by both parents, this is of great help for him/her and his/her integral training.

[4]Assures that an important risk factor for the health of women is having to raise two or more children, since, while doing the hard task of taking care of and protecting them, it has been proven that women's health has gone declining in a gradual way. In the psychosocial aspects of genders, mothers' health is influenced differently than the fathers'.

Similarly, excluding one of the parents could lead to the symptoms of post-traumatic stress, the parentalization of equivocal roles among the family, inappropriate behavior changes, problems of social and emotional integration, regressive symptoms according to their age, among others. Which could be derived into serious problems in future relations of the children.[5] Manifests that one of the relevant factors is the joint custody, which is defined as a method where parents can better organize their time in aspects such as personal, family, social and other complementary activities, without leaving aside their obligations to their children, also allowing mothers not to neglect or send to background their work activities so that this doesn't affect their economic situation.

Joint custody more than a regulation is an opportunity for children to be and live with their parents and thus maintain a relationship of love and affection with both parents. In addition, by incorporating the joint custody within our legal system, we would be looking after the best interests of children. For this reason, joint custody has implied prior investigations. In [5], an analysis about joint custody was carried out, from which basic parameters are established in order to vest that legal status, such as: the aptitude of parents, the age of the children and the period of time, the cases in which the joint custody does not proceed; for example, in case of child abuse.

Those are the reasons why a Law Reform is proposed to include joint custody in the Legislation. Particularly in Ecuador, the Organic Code of Childhood and Adolescence is currently in force. Within Ecuadorian legislation, this code is the legal instrument applied in relation to the care and protection of children and adolescents who are going to live with one of his/her parents, after the divorce or separation.

There are several forms of joint custody. In the first place, we may mention exclusive custody, which according to [6]; "Implies granting custody to one of the parents and a visits schedule in favor of the other, which usually contributes to the raising of the children with a food pension". This type of custody is what is contemplated within our legal system, and applied by the judges, since it is considered the most appropriate for the integral development of children, which in our opinion is totally inadmissible, because with this type of custody we would only be setting parent and son apart.

Alternate custody is another type of custody, which allows each of the parents to have their children for a period of the year, during which they exercise full rights of custody, having a regime of visits in the remaining period.

The last typology is shared or joint custody, which is a right in which both parents have the physical and legal custody of their children, share rights and responsibilities in education, training, maintenance, and all activities related to the raising of children. That way that they take part, by judicial resolution and under equal conditions,

in all the decisions and actions related to the children. [7] Defines joint custody as if it were an intact family because both parents are always sharing their daily activities with their children.

Regarding the legal regulations, article 44 of the Constitution of the Republic [2] declares that: "The State, society and the family shall promote as a priority the integral development of girls, boys, and adolescents, and ensure the full exercise of their rights, the principle of their best interests will be met and their rights will prevail over the others". Likewise, article 45 states that: Girls, boys and adolescents shall enjoy the common rights of the human being, in addition to those specific to their age; girls, boys, and adolescents have the right to physical and mental integrity; to have a family and enjoy family and community life; to social participation; to the respect of their freedom and dignity; to be consulted in matters that may affect them; and to get information about their absent family members, unless it is harmful for their well-being.

On the other hand, the Organic Code of Childhood and Adolescence [1], with regard to joint custody, declares in article 118 that: "When the Judge deems it more convenient for the integral development of the son or daughter of a family, trust their care and upbringing to one of the parents, without altering the joint exercise of parental authority, will entrust the custody following the rules of article 106; he may also grant custody with attribution of one or more of the rights and obligations included in parental authority, always taking into account the convenience indicated in the preceding subsection."

Likewise, article 119 of the same Code, regarding to the modifications of the resolutions on custody, states that: custody does not cause enforcement; the Judge may alter it at any time if it is proven that this is appropriate for the correct exercise of the rights of the son or daughter of the family; when it comes to a change of custody; it will be done in a way that does not cause psychological harm to the son or daughter, for which the Judge must provide support measures for the son or daughter and their parents."

Based on the above mentioned, methods, approaches and aspects related to the regulation of the joint custody of children and adolescents after marriage dissolution are studied. Establishing preliminary draft reform for Article 118 of the Organic Code of Childhood and Adolescence on joint custody after marriage dissolution, to regulate the rights of children and adolescents and particularly in Ecuador.

According to the Organic Code of Childhood and Adolescence [1], custody in Ecuador is an institution for the care and upbringing of sons and daughters that is exercised by only one parent, without altering the exercise of joint parental authority developed by parents. Indeed, [8] stated that custody is the order that the judge gives to one of the parents as for the aspects related to raising and educating their sons and daughters. In addition, the exercise of joint parental authority must be respected.

As for the special legislation in Ecuador, it stipulates that the same rules are followed for granting parental authority as well as for suspending or depriving of it, the custody is exercised only by the father or mother with whom the children live. For example, once separated or divorced, the judge is obliged to decide on the situation of the children. In our country, it is usually the mother who keeps custody while the father is obliged to provide an economic pension.

According to[9] , custody in the legal field refers to the power that parents or guardians have over their children or over the child or adolescent that lives with them, in addition, it is their right to keep their children with them and in some cases, this right could be granted to who has a legitimate interest.

The Supreme Norm of Ecuador in 2008 [14], referring to childhood and adolescence, proclaims that this group of people deserves priority attention. Hence the state, society and the family must guarantee the integral development of children and adolescents, in order to ensure their best interest, paying attention to their future rights, specifically, to be able to procreate a family, to be able to enjoy coexistence in family. This point is essential because when divorce or separation of parents occurs it is not guaranteed, since instead of sharing their parent roles they are assigned separated functions and not jointly, which establishes the promotion of a co-responsibility between rights and duties of parents with respect to their children and ultimately reciprocally between members of the family, which includes aspects such as care, nutrition, education and assistance that parents evidently exercise over their children, but this does not prevent the children from helping their parents in certain circumstances.

Joint custody of children and adolescents has consequences on their health as children, but the conflictive relationships between the father and the mother have negative repercussions on the emotional, social, cognitive and academic development of the children. Joint custody of ex-partners with conflictive relationships has repercussions that affect the development of children. Many of these children suffer in silence without being listened, because the mothers or fathers think that the problems affect only the couple and do not concern their sons and daughters.

However, investigations of [10] show important effects on the health of children due to the conflictive relationships of the ex-partners. These children have problems related to socialization, showing isolation, insecurity, aggressiveness, and reduction of social skills.

Likewise, the abovementioned author declares that these children may have depressive symptoms such as crying, sadness or low self-esteem. The fear in them is reflected as non-specific, as shown by the feeling that

something bad is going to happen, they have fear of death, fear of losing their mother, fear of losing their father, and so on.

The mentioned author also affirms that there are children and adolescents who frequently suffer from sleep disorders, such as nightmares, night terrors, refusing to sleep alone. Also, regressive symptoms such as enuresis, encopresis, delayed language development, behave as if they were younger than their age. On the other hand, these children usually have integration problems at school, which are reflected as they having learning problems, difficulties in concentration and attention, decrease in school performance, difficulty to share with other children.

She also mentions the fact that in this group of people we may find emotional and behavioral responses, such as anger, sudden changes in mood, anxiety, feeling of vulnerability and experiencing the world as something threatening, feelings of guilt (being the cause of the conflicts between their parents or what happened or not having done something to avoid separation). Difficulty in expression and emotions handling. Denial of the conflictive situation or downplay the problem they live. They tend to normalize suffering and aggression as natural modes of relationship. Learning of violent models and the possibility of repeating them, with the internalization of erroneous gender roles.

On the other hand, she points out that they are exposed to chronic parental conflicts, which can lead them to develop more conflictive relationships and addictions. Stress associated to parental violence can lead him or her to assume risky and evasive behaviors and begin to act violently at home or even flee from home. Parents' relationships may also have great influence on the way adolescents establish their first sentimental relationships. The higher levels of conflict and aggression between parents, the more likely it is for them to see hostile intentions in others' behavior, therefore reacting violently as a defense. They have symptoms of post-traumatic stress such as insomnia, recurrent nightmares, phobias, anxiety, trauma re-experiencing, dissociative disorders.

She also mentions the frequent occurrence of children's parentification, due to the assumption of parental and protective roles for younger brothers and sisters, as well as assuming parental roles for protecting their mother. Regarding this section, it is important to highlight that when there is a violent atmosphere and conflictive parental relationships, it affects the way the child perceives the world, his ideas about the meaning and purpose of life and his expectations of a future happiness.

2 Materials and methods

In this paper, descriptive research was carried out, since the most important characteristics and elements of children and adolescents custody were established, taking into account what is stipulated by the Constitution and the Code of Childhood and Adolescence.

Likewise, a documentary research design was applied since bibliographical and second-hand digital sources were consulted, as well as laws and legal instruments related to this topic. The doctrine regarding joint custody, the National Constitution and the Code of Childhood and Adolescence were essential for the development of this study. In addition, this research was enclosed into a field investigation, which allowed obtaining information directly from reality under study.

As for the techniques and instruments for information gathering, we used the poll as a technique and the questionnaire as an instrument. We analyzed a population of 260 people from El Sagrario parish in the city of Ibarra. By applying the formula to select the sample, we chose a total of 155 people. It is important to point out that for the study sample we worked with a direct population sample. That is, without stratification due to the similarity of criteria and positions regarding the joint custody of children and adolescents after marriage dissolution.

Finally, neutrosophy is used to obtain greater interpretability of the linguistic terms related to the issues that cause health consequences to the children, given the conflictive relationships between the father and the mother, which have a negative impact on the emotional, social, cognitive and academic development of children. This technique, as a method, helps to understand which issues should be addressed prioritarily to reduce health consequences for children and adolescents in joint custody.

Neutrosophy is a new branch of philosophy that, according to [10], studies the origin, nature and scope of neutralities, as well as their interactions with different ideational spectra, where (A) is an idea, proposition, theory, event, concept or entity; anti (A) is the opposite of (A); and (neut-A) means neither (A) nor anti (A), that is, the neutrality between the two extremes [17]. Etymologically neutron-sofía [French neutre <Latin neuter, neutral, and Greek sophia, knowledge] means knowledge of neutral thoughts and began in 1995.

His fundamental theory states that every idea <A> tends to be neutralized, diminished, balanced by <noA>. Ideas (not only <antiA> as Hegel defined it) in a state of equilibrium. <noA> = what is not <A>, <antiA> = the opposite of <A>, and <neutA> = what is neither <A> nor <antiA>.

In their classical form <A>, <neutA>, <antiA> are disjoint in pairs. As in several cases the boundaries between concepts are vague and imprecise, it is possible that <A>, <neutA>, <antiA> (and <nonA> of course) have common parts. For example; two parts in two. This theory has settled the basis for neutrosophic logic [18], neutrosophic sets [11], neutrosophic probability, neutrosophic statistic and multiple practical applications. For this

reason, it is used in this investigation for defining the evaluation frame of the issues that children and adolescents face when their parents get divorced, for them the information to be considered is verbalized and the linguistic terms, defined by[12], are shown in table 1.

Linguistic term	SVN number
Extremely good (EG)	(1,0,0)
Very very good (VVG)	(0.9, 0.1, 0.1)
Very good (VG)	(0.8,0,15,0.20)
Good (G)	(0.70,0.25,0.30)
Moderately good (MDG)	(0.60,0.35,0.40)
Medium (M)	(0.50,0.50,0.50)
Moderately bad (MDB)	(0.40,0.65,0.60)
Bad (B)	(0.30,0.75,0.70)
Very bad (VB)	(0.20,0.85,0.80)
Very very bad (VVB)	(0.10,0.90,0.90)
Extremely bad (EB)	(0,1,1)

Table 1. Linguistic terms used. Source: [21].

Once the prioritization framework is established, information is obtained. The ideal alternative is selected, considering the preferences of the experts, which are shown in table 2.

	x_1	x_2	x_3
c_1	MDG	B	VVG
c_2	G	VVG	G
c_3	G	MDB	VG

Table 2. Preferences according to the experts.

Based on the information obtained and considering table 1 and 2, the ideal alternative is selected. Through the results obtained from the distances, it is possible to sort the alternatives according to the preferences obtained and the experts' criteria. Distance calculation is made according to the values shown in table 3.

Criteria	Preferences
x1	0.35355339
x2	0.59160798
x3	0.18484228

Table 3. Values for distance calculation between alternatives and experts' criteria.

Figure 1 shows the workflow for the establishment of the evaluation frame for issues that children and adolescents face when their parents get divorced. Considering the trends that they describe during their development, which are represented in linguistic terms, where indetermination is present.

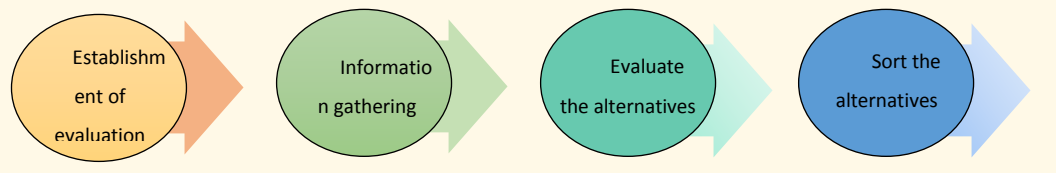

Figure 1. Proposed model.

Detailed description for each of the components of the model for the issues faced by children and adolescents after marriage dissolution are presented below.

1. Establishment of evaluation aspects

In this component, the criteria and alternatives to be evaluated are selected in order to give priority to the last ones. The framework is defined as follows:

- C = $\{c1, c2, ..., cn\}$ with $n \geq 2$, a set of criteria
- E = $\{e1, e2, ..., ek\}$ with $k \geq 1$, a set of experts
- $X = \{x1, x2, ..., xm\}$ with $m \geq 2$, a finite set of alternatives

2. Information gathering

Information about decision-makers' preferences is obtained. The utility vector is represented as follows:

- $Pj = \{p_{j1}, p_{j2}, \ldots, p_{jk}\}$, where p_{jk} is the preference in relation to the criterion c_k of alternative x_j

Evaluations will be defined by single valued numbers (SVN).

3. Evaluate the alternatives

The alternatives are evaluated and the construction of the alternative that uses aggregation operators is proposed.

4. Sort the alternatives

In this phase, the alternatives are classified and the most convenient is chosen by the scoring function [12]. According to the scoring and precision functions for SVN sets, a sort order for the set of alternatives can be generated. Then select the option (s) with higher scores. To order alternatives, a scoring function [13] is used:

$$s(V_j) = 2 + T_j - F_j - I_j \qquad (1)$$

Additionally, the precision function is defined as follows:

$$a(V_j) = T_j - F_j \qquad (2)$$

and so:

If $s(Vj) < s(Vi)$, then Vj is less than Vi, denoted as $Vj < Vi$

In case that $s(Vj) = s(Vi)$

- If $a\,(Vj) < a\,(Vi)$, then Vj is less than Vi, denoted as $Vj < Vi$
- If $a\,(Vj) = a\,(Vi)$, then Vj and Vi are equal, denoted as $Vj = Vi$

3 Results

Applying the instrument for data and information gathering we obtained the evidence that rights are violated when the custody of the children is not shared. On the other hand, it is emphasized that the upbringing and care of the children is affected when it is granted only to one of the spouses.

In the instruments applied, it is indicated that the Constitution of the Republic of Ecuador does allow the incorporation of the legal concept of joint custody since, being a norm to guarantee rights, its essence is the care and protection of persons. Regarding the **preliminary draft reform of Article 118 of the Organic Code of Childhood and Adolescence on joint custody, it was deemed a need.**

Making use of neutrosophy to recommend the issues to treat in children and adolescents after marriage dissolution we obtained:

An evaluation framework comprising an expert who evaluated 3 alternatives:

- x1: (ED) Emotional Development
- x2: (SD) Social Development
- x3: (CD) Cognitive Development

and 3 criteria as shown below:

- c1: Depressive symptoms such as crying, sadness, low self-esteem.
- c2: Problems of socialization, showing isolation, insecurity, aggressiveness, and reduction of social skills.
- c3: Learning problems, difficulties in concentration and attention, a decrease in school performance.

We used table 1 to evaluate the relationship between linguistic terms according to the alternatives and criteria mentioned above. Once the evaluation framework is defined, we proceed to information gathering. The results for our study case are shown in table 4.

	x1	**x2**	**x3**
c1	MDG	EG	VG
c2	G	MDG	M
c3	MDG	MDG	G

Table 4. Results obtained from information gathering.

Weights vector that will be used in this investigation is: W = (0.55, 0.26, 0.19). Subsequently, the opinions of decision-makers are added through the aggregation operator SVNWA. This operator is the Single Value Neutrosophy Weighted Average (SVNWA) proposed by Ye [14] and defined as follows [15]:

$$F_w(A_1, A_2, \ldots, A_n) = \langle 1 - \prod_{j=1}\left(1 - T_{A_j}(x)\right)^{w_j}, \prod_{j=1}\left(I_{A_j}(x)\right)^{w_j}, \prod_{j=1}\left(F_{A_j}(x)\right)^{w_j} \rangle \qquad (3)$$

where $W = (w1, w1, ..., wn)$ is the weight vector of Aj (j = 1,2, ..., n) such that, $wn \in [0,1]$ and $\Sigma wj = 1nj$.

Results are shown in table 5.

	Aggregation	**Scoring**	**Ranking**
x1	(0.53, 0.4, 0.56)	1.73	2
x2	(0.43, 0.0, 0.0)	2.43	1
x3	(0.66, 0.52, 0.63)	1.62	3

Table 5. Evaluation results.

According to the scoring function, the alternatives are sorted like this: $x2 \succ x1 \succ x3$. That is, Social

development ≻ Emotional development ≻ Cognitive development, which means that attention should be paid to social development of children and adolescents after marriage dissolution since this alternative leads to the emotional development and therefore to the cognitive development.

Conclusion

Parents' separation generates conflicts regarding the custody of the children. There are disputes in courts as if a kid were trophy, and this happens precisely because there is a gender inequality within our Code of Childhood and Adolescence, which contemplates unilateral custody, giving preference to the mother over the children, leaving the father in a secondary level.

When marriages and unions fail, comes the divorce, which is increasing every day according to its rate. It is then, within this separation process, where the conflict of children's custody is originated, since one of the parents doesn't agree with the separation, and becomes a visitor in accordance to our laws; being a Judge who determines the visiting schedule which usually is one day a week.

Likewise, it is demonstrated that the joint custody of children and adolescents affects the emotional, social and cognitive development of this group of people. Results obtained after applying neutrosophy prove the aforementioned, so it is worth mentioning that, with the use of neutrosophy we can obtain the alternatives that must be met according to the experts' criteria and the results of the diagnosis carried out in this investigation.

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Received: January 27, 2019. Accepted: May 9, 2019

Use of Neutrosophy to recommend conceptions related to the integral protection of the right to life

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Abstract. In this study, we identify the main ways of understanding the right to life from its conceptions in a general way. Specific conceptions about the right to life are identified and analyzed. Neutrosophy is used to recommend the conceptions that have received the greatest reception in the literature and that are not taken into account for the integral protection of the right to life, considering that the right to life is the starting point for other human rights. In particular, the rights inherent to the human being are described; which, by means of this condition, require not only its recognition by the state and all the society but also its preservation and the guarantee of its full existence. On the basis of such statement, the present study analyzes from a basically legal perspective, without leaving aside the philosophical approach, not only its national and international recognition but also the challenges and problems that this problematic faces, given the various analyses that have been carried out on this topic. Analyzes that have been subjected to sociological and ethical studies about the legal interruption of life. For this reason, the objective of the present investigation is to identify the integral protection of the right to life from its very conceptions.

Keywords: Neutrosophy, integral protection, right to life, conception of the right to life, abortion, decriminalization

1 Introduction

The present investigation is carried out after studies on the origin of life. In general terms it is possible to affirm that national dogmatics has not been concerned with providing and analyzing a definition of the right to life itself. In fact, if any constitutional law manual is revised, it is possible to verify that there is no concrete definition of what the right to life is or what it means. For this reason, an analysis of the origin of life is made from the existence of a human being.

The Constitution of the Republic of Ecuador in its article 45, indicates, verbatim, that girls, boys and adolescents will enjoy the common rights of the human being, in addition to those specific to their age. The State will recognize and guarantee life, including care and protection from the conception, [1] of which it is deduced that the Ecuadorian state guarantees the right to life, considering that there are currently numerous criteria related to the decriminalization of abortion.

In society and despite the shadows of the so-called culture of death, a more lucid consciousness is being developed about the importance of protecting life against the threats of abortion and euthanasia. At the same time, it is noticed that it is not only a matter of religious nature and that it only compels in conscience those who practice a certain religion, as stated by[2] .

The aforementioned author thinks that life, as an inviolable value and the protection of it from its conception, is a fundamental matter in the defense of human rights. Reasons which indicate that legislation cannot ignore the reality of the existence of human life in its gestation stage, as science and in particular biology have evidently revealed.

The same author also mentions that there are revolutionary discoveries, such as in vitro fertilization and DNA with the sequencing of the human genome, leaving evidence that from the moment of conception there is a new human life, a new being. So much so that, in modern legal systems, DNA has become the ultimate test to determine the identity of people.

On the other hand, he indicates that regardless of age, and even, in the hypothesis of devastation, that is, when practically there is nothing left of the human being, even after a long time, the true degree of civilization of a nation is measured on how it protects the neediest. That is why the weakest should be protected. Because the criterion is no longer the value of the subject in terms of the affections it arouses in others, or the utility it provides, but the value that results from his mere existence.

For [3] the conception occurs in the mother's womb. She considers that this person is already a human being who has all the rights, except the patrimonial ones, which he acquires after birth . In the New England Journal of Medicine, published a review of the medical literature, which indicates that fertilization occurs in the fallopian tube 24 to 48 hours after ovulation. Implantation occurs about seven days after conception, wich is consistent with the previous analysis of the medical sciences, pointing out, that life is originated at the moment of conception and that fertilization is considered the process of continuation of the life within the matrix.

The right to life is one of the fundamental rights of the human being. It is among one of the main rights that human beings have. They are supported by international treaties and agreements. The main dilemma is to define from which moment we can consider that a human being has life. It is essential that experts analyze from the perspective of Bioethics and Law the importance that should be given to this particular and main right that is the right to life from its conception [4].

On the other hand, [3] manifests about international treaties and agreements regarding the defense of the right to life as a fundamental right in the Ecuadorian constitutional framework, where the right to life is indicated as a subjective recognition for the first time in article third of the Universal Declaration of Human Rights of 1948, which exposes that every individual has the right to life, liberty and security, because it is considered the most important right of a person and which the rest of the rights depend on. Without this right well protected the other rights wouldn't have a reason to exist.

Based on the aforementioned and the studies of , five conceptions about the right to life are identified:

1) Sustains that the right to life consists of the right to live, to stay alive.
2) Suggests that the right to life consists of the right to live well, or to live with dignity.
3) Proposes to understand that the right to life consists of the right to receive everything that is minimally necessary not to die immediately.
4) Proposes to understand the right to life simply as the right not to be killed.
5) Support the idea that this right consists in not being arbitrarily killed.

The right to life consists of the right not to be arbitrarily killed. In particular, conception number 5 is based on the fact that the object of the right to life is not life as a phenomenal reality, but behavior of third parties, arbitrarily killing another. Consequently with the aforementioned, we distinguish the right to life from life itself, defined by [5] as a distinction that is not frequent in legal literature and is, in particular, the one that assumes that the right to life has a life as a phenomenal reality as its object, except for one case.

That's why [6] states that there are several reasons to accept the distinction between the right to life and life itself and understand that the object of the right to life is not life. This author expresses that in order to determine the object of the right to life we must start from:

- ✓ A general consideration of the right to life as it was referred by[7] emphasizes that fundamental rights include rights to something, freedoms, and competences. The object of a *right to something* cannot be a conduct of its owner or a thing or entity. If the object of the right was the behavior of the owner, there would be no legal relationship but a solipsistic figure, in addition, a right would be confused with freedom. A right to something implies a legal relationship with other subjects. What cannot be the object of a right a thing or entity, because the right would be structured as a dyadic relationship between the owner and the thing. Dyadic relationships - like solipsism – have no legal relevance because they do not regulate the conduct of third parties.
- ✓ A second reason to rule out that the object of the right to life may be life, is when there is evidence that someone can lose their life as a phenomenal reality (or biological support, as some authors call it), without violating his right to life. In effect, a person can die without being killed arbitrarily, for example, in the case of an incurable disease. The opposite assumes that all deaths occur due to homicide.
- ✓ And as a third reason, we have the development of comparative constitutional jurisprudence on the right to life. Foreign Constitutional Courts have dealt with the right to life especially resolving requirements in relation to laws that penalized or decriminalized abortion.

Other reasons in favor of the conception of the right to life and that claim that the right to life consists of the right to live, to stay alive or to continue living are explained in the conceptions about the right to life studied by [6].

The first conception sustains that the right to life consists of the right to live, to stay alive or to continue living. Points out that several authors in the literature make statements that allow us to think that they support to this conception:

- ✓ That every human being has the essential right to preserve his life ... (...). Life, being the primary gift

that God has given to man, and being the source of its other attributes, is protected by constitutional and legal institutionality.

Authors such as [7] allude to the right to life and warn us that the right to life is the most important right, because it is the assumption, basis and purpose of all other rights, without exception. To lose your life is to be deprived of all the rights that only having it makes it possible to enjoy.

Further on, the aforementioned author affirms that this statement refers to the person who is in the womb. A person who has the right to live. What makes it possible to infer that the right to life means the right to live, and a right to life means the right to be alive.

On the other hand [7] shares the same position, the right to life and the physical integrity of the person are the fundamental rights par excellence. Fundament that makes us keep in mind that it is not just about one of the many rights that are found in various declarations, letters and lists, but that it constitutes a kind of *germ* right, beginning of all others and, therefore, especially relevant and essential. In fact, says the abovementioned author that, life has the particularity of being not only an attribute of the human being but confused with himself.

In the second conception, it is suggested that the right to life should be considered as the right to live well, or live with dignity. This conception is related to the first one. Authors like point out that the right to life not only consists of the right to live but also to live well, to live with dignity. The right to life includes progress in the biological sciences and medical technology, in order to save the existence of those who suffer from diseases that endanger it or to provide a dignified extension of their experience.

Specifically, [8] refers that this second conception of living well, is something different for a religious person, for a liberal, for a utilitarian, for a hedonist. The aforementioned author sustains that the right to life consists in the right to live well. But this right may be unreachable for many people and for that reason this conception is rejected for all experts on the subject.

The third conception about the right to life is about the one according to which the right to life includes having the right to be given what we minimally need so that life may continue. [3] Refers that, if a person is fainting from hunger and therefore needs food, their right to life includes the right to receive food. If that person is about to freeze and the way to avoid it is to allow him to enter in my house, then his right to life includes the right to enter my home. Conception similar to that of the person having the right to live and continue living, but not identical, because the conception that is now explained does not imply immortality. Which is the reason why this conception is rejected.

According to [9], the way of understanding the right to life allows us to think of innumerable situations in which someone would have a right to receive something if this would save his life and, correlatively, would place other people in countless situations of having obligations in front of third parties. This happens because this perspective founds the right to life in the causality of life conservation.

A fourth conception states that the right to life consists of the right not to be killed. In the national doctrine, they do not notice that this position is subscribed, and in particular when it is explained what is the right to life. However, the situation changes when they refer to the situation of the nasciturus. It is held in different doctrines, that the nasciturus is personal in that sense. [10] Refers that you have the right to life if it is protected by the constitution of each country. Consequently, the above mentioned means that the right to life of the nasciturus is understood as absolutely never killing.

The notion of the right to life is analyzed by [9], this author emphasizes that this position is more restricted than the previous one. It doesn't generate positive obligations of life conservation for millions of people; it only imposes the negative obligation not to kill. In this sense, this fourth conception approaches the strictest conception presented since the beginning of the analysis related to - not to kill arbitrarily - but it differs from it because it does not include the clause of arbitrariness.

According to this fourth conception, the obligation that falls on third parties is simply not to kill. Therefore, it is not acceptable to subscribe to a conception of the right to life of an absolute nature, for anyone, even including the nasciturus.

Reviewed and analyzed the four conceptions about the right to life having arguments to discard them. It is sustained that the right to life consists simply of the right not to be arbitrarily killed. [10] Refers that this way of understanding the right to life avoids confusion, as happens with most of the doctrines that correspond to the right to life, in particular, the doctrine related to the right to health or the right to physical integrity.

Specifically for the right to health, it is difficult, since this doctrine does not have this right, given the dogmatic lucubrations referred to it in legal literature. On the other hand, reference is made to the right to physical and mental integrity. In this sense, it is necessary to infringe that the right to physical or mental integrity is violated concerning the right to life. In summary, it is expressed that right to life means:

a. Negative primary obligation not to arbitrarily kill another.
b. Secondary positive obligations necessary to prevent arbitrarily killing another.
   - ✓ These obligations are numerous and must be determined through the provision of a Penal Code that

impose sanctions for homicide, having Prosecutors to accuse and courts to punish lawbreakers; have prisons; have police to do preventive work, and some other actions related to the causes or conditions that lead someone to kill another.

c. Eventually, positive obligations designed to satisfy – comply with the right, which should be determined.

2 Materials and methods

The investigation was carried out applying the inductive method, which allowed defining, mainly because the concept of life is determined in an individual way; its biological and religious evolution, considerations of what defines human rights. Deductive analysis from the general point of view on what is defined as the right to life. Logical historical method because the origin of the right to life has been determined from some historical points of religious and biological evolution, especially since in present times there are life protecting currents and life suspensive currents.

Through the use of scientific methods, systematic and methodical procedures were obtained in order to determine the feasibility of developing a proactive and critical analysis of the defense and protection of life from its conception as disposed by the Constitution. In addition, the analytical method was used to carry out a detailed analysis and a thorough constitutional study regarding the rights of life.

Neutrosophy is used to recommend conceptions related to the integral protection of the Law and to pay attention to the most impactful conceptions to achieve a social balance regarding the right to life. Neutrosophy is a new branch of philosophy which studies the origin, nature and scope of neutralities, as well as their interactions with different ideational spectra, created by Professor Florentin Smarandache [11]. His fundamental theory affirms that every idea tends to be neutralized, diminished, and balanced by ideas as an equilibrium state.

The term "neutrosophic" was proposed because it etymologically comes from "neutrosophy", which means knowledge of the neutral thought, and this third neutral represents the main distinction. That is, the unknown neutral indeterminate part (in addition to the "truth" "membership" and "falsehood", components of "non-membership" that appear in fuzzy logic sets). Neutrosophic Logic is a generalization of Zadeh's fuzzy logic [12], and especially of Atanassov's intuitive fuzzy logic [12] and other logics.

In this paper, a recommendation model is used, which is useful to recommend the conceptions related to the right to life having the highest incidence on individuals from the legal point of view. The recommendation model to develop is based on the information gathered by these models and the algorithms used to generate the recommendations, in this sense, we distinguish the techniques referred by [10, 12]. Knowledge-based recommendation models make suggestions by inferring about the needs of experts (preferably jurists according to [19, 20]). The knowledge-based approach stands out in the sense that they use knowledge about how the object of study, in particular, can meet the required needs, and therefore has the ability to figure out how can they meet the user needs, and therefore has the ability to think about the relationship between a need and the possible recommendation that will be displayed.

This type of model is based on the construction of user profiles as a knowledge structure that supports inference, which can be enriched with the use of expressions that use natural language [13]. The workflow for our case study is based on Cordón's proposal [9, 12] for knowledge-based recommendation systems allowing the representation of linguistic terms and indetermination by means of single valued neutrosophic sets (SVN), [14].

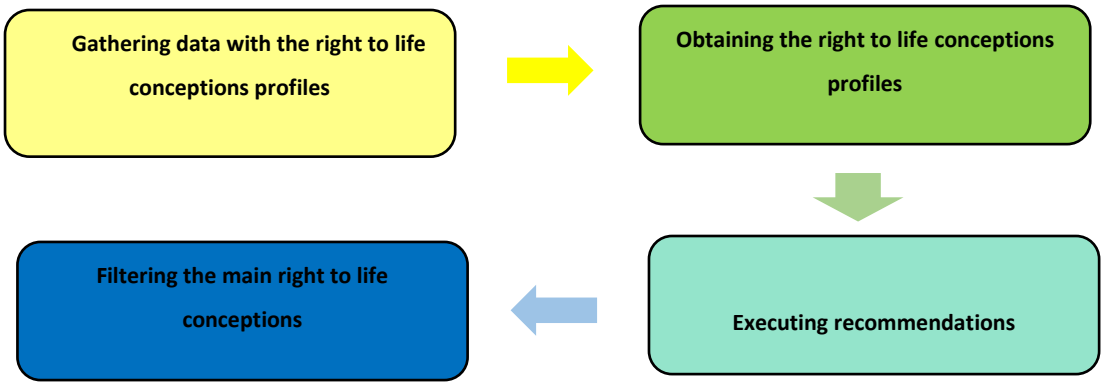

Figure 1: Proposed model.

The detailed description of each activity and the mathematical model supporting the proposal is presented below:

1. Gathering data with the right to life conceptions profiles

Each one of the conceptions is described by a set of characteristics that will conform the right to life conceptions profiles.

$$C= \{c1, \dots ,,\dots,cl\} \quad (1)$$

To obtain conceptions database, the right to life conceptions profile is obtained through single valued neutrosophic numbers (SVN) [24, 25].

Let $A^* = (A1^*, A2^*, .., An^*)$ be a vector of SVN numbers such that $Aj^* = (aj^*, bj^*, cj^*)$ j = (1,2, ..., n) and $Bi = (Bi1, Bi2, ..., Bim)$ (i = 1,2, ..., m) are m vectors of n SVN numbers such that y $Bij = (aij, bij, cij)$ (i = 1,2, ..., m), (j = 1,2, ..., n), then the Euclidean distance is defined as the Bi and A^* results [24]:

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

After obtaining the Euclidean distance, a measure of similarity is defined as referred by [14].

To the extent that the alternative Ai is closer to the right to life conceptions profile (si) the greater the similarity, which allows establishing an order between alternatives according to [13]. The right to life conceptions profile can be obtained directly from the experts, for which equation 3 is used.

$$F_{a_j}=\{v_1^j,\dots,v_k^j,\dots v_l^j\},j=1,\dots n \quad (3)$$

The assessments of the characteristics of the right to life main conceptions, a_j, will be expressed using the linguistic scale S, $v_k^j \in S$ where S = {s1, ..., sg} corresponding to the second set of linguistic terms defined to evaluate the characteristics c_k using the SVN numbers. For this, the linguistic terms to be used are defined once the set of conceptions related to the right to life have been described and are represented according to expression 4.

$$A=\{a1,\dots,aj,\dots,an\} \quad (4)$$

The set of conceptions related to the right to life is stored in a previously created Database.

2. Obtaining the right to life conceptions profiles

In this stage the right to life main conceptions are obtained and stored in a profile as shown in expression 5.

$$P_e=\{P_1^e,\dots,P_q^e,\dots,P_l^e\} \quad (5)$$

This profile will consist of a set of attributes that are represented by expression 6 for its interpretation.

$$C_e=\{c_1^e,\dots,c_k^e,\dots,c_l^e\} \quad (6)$$

Where: $c_k^e \in S$

The profile related to the right to life main conceptions is obtained through the so-called conversational approach or through examples which can be adapted according to what is referred by [12].

3. Filtering the main right to life conceptions

In this point, the main right to life conceptions are filtered in order to find which are the most appropriate. To do this, the similarity between the profiles of each conception related to the right to life is calculated, Pe and each studied conception aj registered in the database. For the calculation of the total similarity, expression 7 is used.

$$s_i=\left(1-\frac{1}{3}\sum_{j=1}^{n}\left\{\left(\left|a_{ij}-a_j^*\right|\right)^2+\left(\left|b_{ij}-b_j^*\right|\right)^2+\left(\left|c_{ij}-c_j^*\right|\right)^2\right\}\right)^{\frac{1}{2}} \quad (7)$$

The function S calculates the similarity between the values of the attributes of the profile of each conception

related to the right to life and that of each conception analyzed in this study, αj[15].

4. Run recommendations

Once calculated the similarity between the profile of each conception related to the right to life and each conception analyzed in this study, they are sorted according to the similarity obtained. They are represented according to the similarity vector denoted by expression 8.

$$S = (s_1, \dots, s_n) \quad (8)$$

The conceptions to be treated will be those that best meet the needs of the profile of the right to life conceptions. That is, those having greater similarity with the conceptions of the right tomore general life.

4 Results

Two well-defined trends existing at a global, regional and national level are demonstrated. One related to the legalization of the interruption of life and the other related to the defense of life from its conception, birth, and growth of children. It is highlighted in the study that both trends are analyzed at the global, regional and national levels. They show results that contribute to the projects that have been presented in Ecuador on the decriminalization of abortion, after the entry into force of the Constitution of the Republic of Ecuador in 2008, where article 45 refers to the guarantee of life, its care and integral protection from its very conception.

On the other hand, by making use of Neutrosophy to recommend conceptions related to the integral protection of the law and to address these conceptions in order to achieve social equilibrium relative to the right to life. Using the model proposed in figure 1, the characteristics of the main conceptions of the right to life are obtained through expression 4, A = {a1, a2, a3, a4, a5}. These characteristics are described by the set of attributes C = {c1, c2, c3, c4, c5}.

The set of attributes will be assessed through the linguistic scale shown in Table 1. These assessments are stored in a database in order to recommend which are the conceptions to be considered for the integral protection of the right to life.

Linguistic term	**SVN numbers**
Extremely good (EG)	(1,0,0)
Very very good (VVG)	(0.9, 0.1, 0.1)
Very good (VG)	(0.8,0,15,0.20)
Good (G)	(0.70,0.25,0.30)
Moderately good (MDG)	(0.60,0.35,0.40)
Medium (M)	(0.50,0.50,0.50)
Moderately bad (MDB)	(0.40,0.65,0.60)
Bad (B)	(0.30,0.75,0.70)
Very bad (VB)	(0.20,0.85,0.80)
Very very bad (VVB)	(0.10,0.90,0.90)
Extremely bad (EB)	(0,1,1)

Table 1: Linguistic terms used [24].

Expression 9 shows the recommendations given the information related to the 5 conceptions studied in this paper and according to the linguistic terms shown in table 1.

$$Pe = \{VVG, VG, MDG, VVB, EG\} \quad (9)$$

Based on expression 9, conception 1 related to the sustainability of the right to life comprising the right to live, to stay alive, obtained a value of very very good (VVG). Conception 2, which suggests the right to life and consists of the right to live well, or live with dignity, gets very good values (VG). For conception 3, related to the proposal to understand that the right to life consists of the right to receive everything that is minimally necessary not to die

immediately, obtained moderately good values (MDG). On the other hand, conception 4 related to the understanding of the right to life only as the right not to be killed, obtains a very very good value (VVG). And finally, conception 5, which is the most relevant and is associated to the right not to be arbitrarily killed, specifically as for the way of conceiving the right to life, obtained an extremely good value (EG).

Results obtained in the recommendations sustain that, out of the five conceptions, number 1, 2, 4 and 5 have had reception in the literature, especially conception 5, the one related to the way of conceiving the right to life.

Once the recommendations were obtained, we calculated the similarity between the conceptions of the right to the life in a general way and the conceptions of the obtained profile related to the right to life, specifically of the five conceptions studied. Results are shown in table 2.

$a1$	$a2$	$a3$	$a4$	$a5$
0.84	0.80	0.52	0.90	0.95

Table 2: Similarity between the right to life conceptions and the conceptions of the obtained profile related to the right to life.

Based on the results we obtained, recommended conceptions are those closest to the profile related to the right to life. A way of sorting of the conceptions according to the comparison would be {a5, a4, a1, a2}.

In case of a recommendation for the profiles related to the right to life, it is recommended for our case study to address the two closest profiles. This would be recommendations $a4$ and $a5$, consistent with the concept of the right to life simply as the right not to be killed, and the right to not be arbitrarily killed, specifically with regard to the way of conceiving the right to life.

According to profiles, it is worth highlighting that in Ecuador there are laws, regulations of prevention and reproductive sexual health put into effect as a public policy that is legally analyzed. Based on the above declared, it can be said that the state has implemented ways of reaching adolescents to achieve a true social and moral conscience to protect their sexual modesty. It is an interesting fact that in Ecuador, humans are aware they have affective relationships with their children, they love the family and the environment.

Conclusion

In the study carried out, the main ways of understanding the right to life have been identified from its conceptions. For that purpose, specific conceptions about the right to life have been identified and analyzed, using Neutrosophy to recommend the conceptions having the best reception in the literature while being not considered for the integral protection of the right to life.

We also presented a recommendation model of the most followed conceptions related to the understanding of the right to life in Ecuador. The model follows a knowledge-based approach, specifically based on the use of SVN numbers to express linguistic terms.

We made analysis from a legal perspective, without leaving aside the philosophical point of view, about the recognition of the challenges and problems faced by the problematic previously analyzed at national and international level, whose analysis has been subjected to sociological and ethics studies about the legal interruption of life.

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Received: January 27, 2019. Accepted: May 11, 2019

Use of the neutrosophic IADOV technique to diagnose the real state of citizen participation and social control, exercised by young people in Ecuador

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Abstract. The rights of individuals, as well as the exercise of those rights, are fundamental in the development of any society, which is why the current Constitution opened a field of action for citizen participation, based on the precept that sovereignty lies in the people and whose will is the basis of the authority exercised through the organs of public power and the democratic means provided for. The field study and specifically the survey revealed that the young people of the province are unaware not only of their rights as citizens, but also of the existence of mechanisms for citizen participation, such as the empty chair. With the purpose of diagnosing the real state of citizen participation and social control exercised by young people in Ecuador, survey instruments were applied that evaluated through a complex methodology that integrates the IADOV method and the neutrosophic logic, the transcendence of the reversal of the burden of proof over the non-existence of untimely dismissal in Ecuador.

Keywords: Citizen participation, mechanisms of participation, sovereignty, neutrosophic IADOV technique

1 Introduction

In a democratic state like Ecuador, citizen participation is fundamental for the development of the state administrative apparatus, since democracy, which is the will of the people, must be respected in all spheres of public power; citizen participation being understood as "the incidence of individuals and social groups in the different stages in which matters of public interest are resolved, that is, in consultation, discussions, proposals, and all kinds of activities in which the state and citizens interrelate for the progress of the community" [1]. Despite the fact that Ecuador was born as a democratic republic, the recognition of citizen participation in decision-making by state powers in a more direct and participatory manner has only recently been conceptualized. It has gained strength in the last three decades, especially since the 2008 Montecristi Constitution came into force, in response to the need to confront rampant corruption in the public sector [2].

The specific solution to the problem of corruption consisted of delegating to the citizen the task of monitoring and being attentive to the activity carried out by the public official, so that in this way he or she would be the first to denounce and bring to light any acts of corruption that might arise. However, in order for the citizen to carry out this monitoring activity, it was necessary to incorporate in the Constitution a new function of the state and this is how it is in the 2008 Constitution (Art. 204. Inc.2) incorporates that of "Transparency and Social Control" with the purpose of promoting and encouraging through the citizenry the control of public sector entities and organizations and natural or legal persons from the private sector that provide services or develop activities of public interest, thus protecting the exercise and enforcement of rights and prevent and combat corruption. In some cases, its application has been proven in practice and its effectiveness has been demonstrated in the field [2].

Article 72 of the Organic Law of Citizen Participation (LOPC)[3] , establishes as participation mechanisms: public hearings, popular councils, the empty chair, observatories and advisory councils; and also defines citizen partition mechanisms as "instruments with which citizens individually or collectively have to participate in all levels of government established in the Constitution and the Law" (2010). The body in charge within the Transparency and Social Control Function of promoting the use of participation mechanisms among citizens is the Council for Citizen Participation and Social Control (Constitution of the Republic of Ecuador, 2008. Art.207), which is called informing, educating citizens so that they may exercise the rights related to citizen participation, but in addition to citizenship, it also works with the different public entities, so that within each one citizen participation in decision-making is promoted and facilitated.

Within this sphere of action, the Provincial Delegation of the Council for Citizen Participation and Social Control of the Province of Santo Domingo manages and carries out information campaigns for citizens on the rights of citizen participation. Unfortunately, this delegation has focused mainly on local social organizations that are not related to the youth population of the province; For this reason, the objective of this work is to diagnose the participation of young people in the use of mechanisms of citizen participation specifically in the so-called "empty chair", in the decentralized autonomous governments of the province of Santo Domingo de los Tsáchilas.

On the mechanism of citizen participation called empty chair, article 77 of the Organic Law of Citizen Participation states that the sessions of the decentralized autonomous governments are public and in them there will be an empty chair that will be occupied by one or one representative, several or several representatives of the citizenry, depending on the issues to be dealt with, in order to participate in the debate and decision making. The accredited person who participates in the debates and decision-making shall do so with voice and vote. On the basis of these regulations, in municipal council sessions in municipalities and in provincial council sessions - entities known as GAD's decentralized autonomous governments - there must be an "empty chair", which will be occupied by a representative of the citizenry depending on the issues to be discussed, with the purpose of participating in the debate and making decisions in matters of general interest [4].

The first is based on the fact that approximately 28% of the population in the province of Santo Domingo de los Tsáchilas is made up of young people between the ages of 16 and 29, and 30% of those under 16, according to INEC data, which makes it imperative for young people to become aware of the importance of their participation in the country's political life, in order to create a participatory culture that would be inherited by new generations. The second reason is based on a review of the history of Ecuador, in which we found that at the beginning of the last century youth movements whose formation was influenced by the socialist revolution in Russia and later the Cuban revolution, had a leading role in the political life of the country; organizations such as the Federation of University Students of Ecuador (FEUE) or Communist Youth of Ecuador (JCE), or Socialist Youth of Ecuador (JSE) had the power to convene young people to such an extent that more than once they were direct actors in overthrowing dictatorial governments. He refers [3] that although these movements and others still exist, the participation of young people has not been felt with the force that characterized this sector of the population, of course we must recognize that the economic, political, social and even technological situation of that time is far from the current ones and that the young people of the present live a reality totally different from those of yesteryear, but despite this they still have something in common and that is corruption in public administration. According to the identification, definition and improvement of processes and procedures are articulated to an inevitable strategic intention for development that guarantees the achievement of a dynamic of continuous improvement.

Society, like current politics, bears little resemblance to that of those societies [5], young people are affected by a series of tensions and paradoxes, such as, for example, "greater access to education, less employment, more access to information and less access to power, more skills for the communication society and fewer autonomy options, more cohesive within but more segmented into heterogeneous groups with greater impermeability to the outside; more suitable for productive change but more excluded from it. In this world of paradoxes, the pressure of the increasingly demanding labor market is added to competitiveness, so that young people focus their efforts on studies and obtaining a job, becoming mere spectators of the political or social events that occur in their environment.

It should also be noted that there is no real interest on the part of governments to involve young people in the political life of the country, since these are statistically considered as problems to be solved [6]: unwanted pregnancies among young people, delinquency, drug addiction, school desertion, unemployment, and other are the issues that fill the agendas of the authorities in office, forgetting that young people are the "strategic actors of the country's development" (CRE, 2008, Art. 39) and that it is this sector of the population that should be educated on issues of citizen participation, so that they can effectively fulfill this role of strategic actors. Under this scenario, it is very difficult for governments to be aware that it is in the youth population where three aspects must be developed: the interest of young people to participate in political, social and economic issues; the possibility of participation by creating spaces and scenarios for them; and, training according to the need to participate. Statistics show that only 1.2% of young people between the ages of 20 and 29 would have participated in a political party or movement and the causes are found in their lack of interest in forming new cadres and promoting young leaders. In Ecuador, it is characteristic of these political movements to develop under the shadow of a "caudillo" who captures all the attention, so much so that political parties are not identified by their ideologies but by the face and name of those who lead them; this has caused them to lose strength among voters over time and to gain their apathy for the lack of renewal of leaders, ideologies and proposals.

Despite the fact that the 2008 Constitution includes the function of Transparency and Social Control as a means to curb corruption, in the last decade the indices that measure this evil have not dropped, as Ecuador ranks 107th out of 167 countries; The explanation for this contradiction can be found in the fact that the aforementioned function has not been able to reach citizens with the necessary information to exercise the oversight power contemplated in the Constitution. Ordinary citizens are unaware of this right, which is why the objective of our

research is to determine the participation of young people in the empty chair in the Gads of the Province of Santo Domingo de los Tsáchilas and to make proposals that encourage them to participate in this mechanism.

2 Methods

This research followed a quantitative integrative approach, the group of researchers had access to the information contained in documents and after their respective analysis, they were able to follow up, in order to know, monitor, comment, present observations, demand accountability and contribute to the improvement of the administration precisely with the increase of the participation of young people. Theoretical methods such as analysis and synthesis, induction and deduction were used, which, as mental processes, made it possible to reveal the essential relationships of the phenomena studied and, consequently, elaborate the proposal aimed at promoting the participation of young people in the "Empty Chair" mechanism.

As a method applied to the collection of information, different techniques were used, including the analysis of documents, especially the minutes of the sessions of the municipal council and the provincial council from May 2014 to December 2017, in order to determine citizen participation, especially of young people in the mechanism of the empty chair, obtaining results that will be presented later.

Interviews were conducted with different public officials of the provincial Gads involved in the application of the empty chair; all results were processed through percentage analysis, but the numerical data obtained was also interpreted. In the same way, surveys were applied to the community defenders of the province and it was decided to survey this group of the population, since due to their activity as leaders they are citizens who would have a greater option in making use of the empty chair. The survey was elaborated with 7 questions, three closed-ended questions interspersed in four open-ended questions; of which 1 fulfilled the introductory function and three functioned as a reaffirmation and support of objectivity to the respondent.

The questionnaire used in the survey was useful to diagnose the real state of citizen participation and social control, exercised by young people in Ecuador, was taken into account a total of five questions, three of it closed and two open. The three closed-ended questions correspond to the "Iadov Logical Chart", which is presented adapted to the present research and is shown in Table 1.

	Would it be opportune to dispense with the citizen participation and social control exercised by young people in Ecuador?								
	No			I don't know			**Yes**		
8. Does the application of the analysis to diagnose citizen participation and social control by young people in Ecuador meet your expectations?	**9.If you could choose freely, an option to diagnose citizen participation and social control, exercised by young people, would you choose one with characteristics similar to those of Ecuador?**								
	Yes	I don't know	No	Yes	I don't know	No	Yes	I don't know	**No**
Very satisfied.	1	2	6	2	2	6	6	6	**6**
Partially satisfied.	2	2	3	2	3	3	6	3	**6**
I don't care.	3	3	3	3	3	3	3	3	**3**
More unsatisfied than satisfied.	6	3	6	3	4	4	3	4	**4**
Not at all satisfied.	6	6	6	6	4	4	6	4	**5**
I don't know what to say.	**2**	**3**	**6**	**3**	**3**	**3**	**6**	**3**	**4**

Table 1: Logical chart by V.A. Iadov to diagnose the real state of citizen participation and social control exercised by young people in Ecuador. Source: Prepared by the authors.

The number resulting from the interrelation of the three questions indicates the position of each respondent in the satisfaction scale, that is, their individual satisfaction. This satisfaction scale is expressed by SVN numbers. The original definition of truth value in neutrosophic logic is shown below[7].

Let N = {(T,I,F): T,I,F ⊆ [0,1]} n, a neutrosophic valuation is a mapping of a group of propositional formulas to N, and for each sentence p we have:

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

In order to facilitate practical application to decision-making and engineering problems, a proposal was made for single-value neutrosophic sets [8] (SVNS), which allow the use of linguistic variables [9], thus increasing the interpretability of recommendation models and the use of indetermination.

Let X be a universe of discourse. An S VNS A on X is an object of form.

$$A = \{\langle x, u_A(x), r_A(x), v_A(x)\rangle : x \in X\}d \quad (2)$$

Where:

$uA(x)$: $X \rightarrow [0,1]$, $rA(x)$: $X \rightarrow [0,1]$ y $vA(x)$: $X \rightarrow [0,1]$, con $0 \leq uA(x) + rA(x) + vA(x) : \leq 3$ for all $x \in X$.

The interval $u(x)$, $rA(x)$ and $vA(x)$ represents the membership to true, indeterminate and false of x in A, respectively. An SVN number for diagnosing citizen participation and social control exercised by young people in Ecuador in this study is expressed as $A = (a, b, c)$, where $a, b, c \in [0.1]$, and $+ b + c \leq \leq 3$. SVN numbers, which are obtained, are useful for referral systems.

In order to analyze the results, a scoring function is established. An adapted scoring function [10] is used to sort the alternatives:

$$s(V) = T - F - I \quad (3)$$

If the evaluation corresponds to indetermination (not defined) (I), a de-neutrosification process was developed as proposed by Salmeron and Smarandache [11]. In this case, $I \in [-1,1]$. Finally, we worked with the average of the extreme values $I \in [0.1]$ to obtain a simple value.

$$\lambda([a_1, a_2]) = \frac{a_1 + a_2}{2} \quad (4)$$

Where I saw corresponds with the importance of the source. This proposal fills a gap in the literature of Iadov's techniques, extending it to deal with indeterminacy and the importance of the user due to experience or any other reason [12].

Based on the above, the individual satisfaction scale shown in Table 2 was used to measure the individual satisfaction of each respondent.

Expression	SVN Number	Score
Clear Satisfaction	(1, 0, 0)	1
More satisfied than dissatisfied	(1, 0.25, 0.25)	0.5
Not defined	I	0
More dissatisfied than satisfied	(0.25, 0.25, 1)	-0.5
Clear dissatisfaction	(0,0,1)	-1
Contradictory	(1,0,1)	0

Table 2: Individual satisfaction scale. Source: [15].

3 Results

This led to the socialization among young people of the empty chair participation mechanism, through an awareness program whose objective was to encourage the citizen participation of young people in the province of Santo Domingo de los Tsáchila. During the development of the activities it was possible to verify that the objectives were met, since the university students were interested in knowing the procedures to be able to make use of the Empty Chair.

Based on the result obtained, the IADOV technique was applied to the criteria used in the survey to diagnose citizen participation and social control exercised by young people in Ecuador. The results of applying IADOV are shown in Table 3.

Expression	Total	%
Clear Satisfaction	14	66
More satisfied than dissatisfied	7	33
Not defined	0	0

More dissatisfied than satisfied	0	0
Clear dissatisfaction	0	0
Contradictory	0	0

Table 3: Results of the application of the IADOV technique to diagnose citizen participation and social control, exercised by young people in Ecuador. Source: Prepared by the authors.

On the results shown in table 3, we calculate the score obtained for each indicator of the expression of table 3 and calculate the Iadov, for our case study was assigned a value in the vector of equal weights $w_1 = w_2 = \cdots = w_i = 0.0485$. The result of the method is ISG =0.83, which means that the diagnosis of citizen participation and social control carried out by young people in Ecuador has a high satisfaction value.

Conclusion

The study shows that there are sufficient legal regulations in the country to exercise the rights of citizen participation. It also shows that citizen participation in Ecuador is not born with the Constitution of 2008, but is institutionalized with it by promoting the formation and participation of different social, economic and political groups in the country.

It shows that citizens in general and young people in particular are unaware of their rights to citizen participation and the different existing mechanisms, especially that of the Empty Chair. The activities aimed at disseminating the empty chair participation mechanism among young people and making them aware of the importance of it being occupied by them as the most important social sector generated great interest in assuming a leading role in the mechanisms of citizen participation.

The validation process using Iadov's neutrosophic technique to diagnose citizen participation and social control, carried out by young people in Ecuador, confirmed its feasibility of use. The results were expressed quantitatively in a high index of satisfaction of the group in the survey applied in our case study.

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Received: January 21, 2019. Accepted: May 9, 2019

Neutrosofic statistics applied to demonstrate the importance of humanistic and higher education components in students of legal careers

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Abstract. In this paper we carry out an analysis of the humanistic and higher education components in students of legal careers. Neutrosophic statistics are used to demonstrate the importance of these components. Thus, person's life is better, insofar as it is filled with meaning and continuous reflection during his (her) existence. For that reason this study aims to analyze humanistic and higher education components of Law School students for their inclusion into the practical activities from an integral perspective.

Keywords: humanistic education, higher education, Law school's students, neutrosophic statistics.

1 Introduction

The training of a highly qualified professional has been a challenge more than an aspiration, and one of the central objectives of any process of development in higher education. However, the accelerated advances in science and technology, along with other socioeconomic and political factors have been causing a gradual shift from classical training to competency-based training, increasingly focused on the development and acquisition of professional knowledge, to the detriment of the humanistic sense and the indispensable integral formation of human beings.

The humanistic training in higher education must be focused on an integral training, where the technical profile of each profession implies the development of the ethical and moral values inherent to the human being. This novel paradigm enables the graduation of professionals with a high humanistic sense, with an open mind in accordance with the multicultural, multiethnic and multilingual diversity of each region or country [1-2].

The bibliographical analysis made from studies which, from common perspectives, include as a center the humanistic training within higher education, upon the need to displace the partiality in the preparation of the university professional. In benefit of the integrity required in these times, makes an approach to the real and contextualized needs of any university training process and its indispensable transformation, from a dual perspective that favors the understanding of its importance in university teachers [3].

The real and contextualized necessities of the university education process and its indispensable transformation are responsible for making viable the promotion of this topic in the educational teaching process of Ecuadorian universities, as referred in [4]. On the basis of the aforementioned elements, it is worth mentioning the studies in [5], which describes the necessity to carry out transformations in the diverse access roads in terms of construction, production, transmission and distribution of knowledge, in full accordance with the call-out made.

On the other hand, according to [6-8] the higher education institutions and universities in particular, have the responsibility to carry out the revolution of thought, as a fundamental way to promote the rest of the necessary transformations. In line with these criteria, outstands the position assumed by Uribe in [9], who bases his work on the necessity to include in higher education, humanistic studies based on philosophical studies, in such a way that this branch does not remain in the field of the merely specialized and incorporates an integral approach, from the individual to the collective, towards a humanistic context as an aspiration to the total knowledge it refers.

Similarly, and for the wide and unquestionable path that Loret, Pino and Nordelo in [10] take in their studies, the aforesaid authors deepen into the humanistic education at university courses in general. Standing out, the systematization for the various theoretical and methodological conceptions supporting the humanistic education at universities, with the purpose to identify the qualities of the professional and the knowledge proposal, which are useful for the construction of the human intellect, characterized by the general performance of the professional.

However, the Constitution of the Republic of Ecuador in 2008 pays special attention to the treatment of education, establishing that education is a right of the people and a duty of the state and that it has the human being as its center of attention, based on a holistic approach, based on the respect for human rights. The Organic Law of Higher Education (LOES is the abbreviation in Spanish), in spite of defining the humanistic character of Higher Education, it highlights within its content what refers to academic and professional training, scientific research, transmission and dissemination of science, technique, technology and culture, without making explicit mention of the education of citizens for the benefit of citizen himself, or humanistic education, as an essential component of the necessary integrality that must be the objective of the university education process.

In this panorama and in accordance with the diverse characteristics of our country, and the generalized globalization of the contemporary era, the approach to legal problems becomes increasingly complex. That is why the development of critical and humanistic thinking is required. Based on the attitude towards life and the search for new knowledge, which allows facing the current challenges of each society, from an ethical, responsible and committed position, to the current demands of a world where social devaluation has emerged and walks in giant steps, it is very important to think in the improvement of the humanistic training in Law university education and in particular at the Regional Autonomous University of the Andes (UNIANDES), Santo Domingo. For this aspect is the starting point to reach the educational standards, according to the demands of our times.

According to [11], a transformative knowledge from eminently technical positions, towards a general education that contemplates multi-ethnic and multicultural aspects, are the ones required for an adaptation of the aforementioned context. From the methodological point of view, the vision of a not so technical teaching, as the transmission of completed and formal knowledge, which places the political commitment in the educational practice, full of ethical and moral values and the development of the person in terms of collaboration among them, constitute the fundamental bases for the development of professional knowledge.

Based on such postulates, free Greeks and Romans cultivated rhetoric, grammar and logic, that is why they were called liberal arts in later humanistic studies, which made them a kind of prestige inherited from classical antiquity. The first approaches to the humanistic ideal were called humanitas, as one of the first classifications of the liberal arts, they contained the following arts: grammar, dialectics, rhetoric, geometry, arithmetic, astronomy, music, medicine and architecture [12-13].

In this sense, according to [14] the humanistic formation of Law school students in general, and just like in all sciences, arts, knowledge and techniques, should illuminate the life of persons, making it better, more livable, to the extent that it continuously fills his existence with meaning and meditation. That is, it is not given exclusively to cultivate concepts, knowledge, and techniques, but for the cultivation of the soul, for raising the dimensions of the person [15]. It means reflecting on his autonomy, capacity for self-realization, inviolable dignity and his openness to others and transcendence [16].

Based on the aforementioned elements, the use of neutrosophic statistics is required to measure the condition of humanistic and university education components in Law students of UNIANDES. With the use of classical statistics, the data are known, formed by sharp numbers. In the neutrosophic statistics, the data have certain indeterminacy. Data may be ambiguous, vague, imprecise, incomplete, even unknown. Instead of sharp numbers used in classical statistics, sets (which are respectively close to these sharp numbers) are used in neutrosophic statistics [17].

In addition, Smarandache refers that in neutrosophic statistics, the sample size may not be known exactly (for example, the sample size could be between 90 and 100, this may happen because, for example, the statistician is not sure of what they approximately refer, which are the individuals of the sample that belong or not to the population of interest, or because the individuals of the sample only belong partially to the population of interest, while they do not belong partially). Another approach would be to consider only partially the data provided by the individuals in the sample whose membership in the population of interest is only partial. Here, a group of experts or teachers evaluate a random sample of students, by using linguistic terms. Later neutrosophic hypothesis test is applied.

This paper is divided in a section called Materials and Methods, which is devoted to summarize the main concepts of neutrosophy theory, especially neutrosophic statistics, as well as other useful concepts. Next, the section of Results is dedicated to calculate and discuss the results obtained. The paper finishes with the section of Conclusions.

2 Materials and methods

In this study, Neutrosophy is used, because it is appropriate to demonstrate the importance of the humanistic and university education components in Law students since these components that are obtained require interpretability. In this sense, neutrosophic as a branch of philosophy which studies the origin, nature and scope of neutralities, created by [18] is used in this study.

The use of neutrosophic was proposed by Smarandache [19] for the treatment of neutralities. It has settled the basis for a series of mathematical theories that generalize classical and fuzzy theories such as neutrosophic sets and neutrosophic logic as referred by [19]. The original definitions of neutrosophic logic are shown by Smarandache in [20], where he

expresses:

Definition 1 Let X be a universe of discourse, a space of points (objects) and x denotes a generic element of X. A *neutrosophic set A* in X is characterized by a truth-membership function $T_A(x)$, an indeterminacy-membership function $I_A(x)$, and a falsity-membership function $F_A(x)$. Where, $T_A(x)$, $I_A(x)$, $F_A(x) \subseteq]^-0, 1^+[$, i.e., they are real standard or nonstandard subsets of the interval $]^-0, 1^+[$. These functions do not satisfy any restriction, that is to say, the following inequalities hold:

$^-0 \leq \inf T_A(x) + \inf I_A(x) + \inf F_A(x) \leq \sup T_A(x) + \sup I_A(x) + \sup F_A(x) \leq 3^+$.

Definition 2 Let X be a universe of discourse, a space of points (objects) and x denotes a generic element of X. A *Single Valued Neutrosophic Set* (SVNS) A in X is characterized by a truth-membership function $T_A(x)$, an indeterminacy-membership function $I_A(x)$, and a falsity-membership function $F_A(x)$. Where, $T_A(x)$, $I_A(x)$, $F_A(x)$: $X \to [0, 1]$ such that: $0 \leq T_A(x) + I_A(x) + F_A(x) \leq 3$. A *single valued neutrosophic number* (SVNN) is symbolized by <T,I,F> for convenience, where T, I, F $\in [0, 1]$ and $0 \leq T + I + F \leq 3$.

Therefore, $A = \{\langle x, T_A(x), I_A(x), F_A(x)\rangle : x \in X\}$ or more simply $A = \langle T_A(x), I_A(x), F_A(x)\rangle$, for every $x \in X$.

Given A and B two SVNSs, they satisfy the following relationships:

13. $A \subseteq B$ if and only if $T_A(x) \leq T_B(x)$, $I_A(x) \geq I_B(x)$ and $F_A(x) \geq F_B(x)$. Particularly, $A = B$ if and only if $A \subseteq B$ and $B \subseteq A$.
14. $A \cup B = \langle \max(T_A(x), T_B(x)), \min(I_A(x), I_B(x)), \min(F_A(x), F_B(x))\rangle$, for every $x \in X$.
15. $A \cap B = \langle \min(T_A(x), T_B(x)), \max(I_A(x), I_B(x)), \max(F_A(x), F_B(x))\rangle$, for every $x \in X$.

Some important concepts of Neutrosophic Statistics are the following:

A *neutrosophic population* is a population where the membership of the individuals is not well defined and a level of indeterminacy could exist. A *neutrosophic sample* is a sample where indeterminacy is in some way present. The origin of indeterminacy can be due to the partial appurtenance of its members or because of the indeterminacy of this subset as a whole.

Example 1 Neutrosophic data can be a crisp value, like 1; an open, closed, semi-open, interval-valued data, like [-1, 1], (-1, 1), [-1, 1) or (-1, 1], moreover, it can be a discrete set like {-1, -0.5, 0, 1}.

Furthermore, the neutrosophic sample size can be an imprecise number.

Essential operations in neutrosophic statistics are based on interval-valued operations. In the following we summarize some of them. Given $I_1 = [a, b]$ and $I_2 = [c, d]$ two real valued intervals, then, see [21]:

17. $I_1 \leq I_2$ if and only if $a \leq c$ and $b \leq d$.
18. $I_1 + I_2 = [a+c, b+d]$.
19. $I_1 - I_2 = [a-d, b-c]$.
20. $I_1.I_2 = [\min(ac, ad, bc, bd), \max(ac, ad, bc, bd)]$.
21. $1/I_1 = [1/b, 1/a]$, always that $0 \notin I_1$.
22. $I_1/I_2 = I_1.(1/I_2)$.
23. $\sqrt{I_1} = [\sqrt{a}, \sqrt{b}]$, if and only if $a \geq 0$.
24. $I_1^n = \underbrace{I_1 \cdot I_1 \cdot \cdots \cdot I_1}_{\text{n times}}$, $n \in N$.

Definition 3 A *Neutrosophic Normal Distribution* is a normal distribution of the random variable X, where either the median μ or the variance σ^2 (standard deviation σ) or both of them are imprecise.

A *neutrosophic hypothesis* satisfies that the statistics of the variables used to describe the population characteristics are neutrosophic or at least one value which describes a population characteristic is neutrosophic.

The *Neutrosophic Null Hypothesis*, denoted by NH_0, is the one which we have to prove it is true; also, the *Neutrosophic Alternative Hypothesis* is defined and denoted as NH_a.

Example 2 Neutrosophic hypotheses can be the following:

$$\begin{cases} NH_0: \mu \in [4, 5] \\ NH_a: \mu \notin [4, 5] \end{cases} \quad \begin{cases} NH_0: \sigma \in [0.5, 1] \\ NH_a: \sigma \notin [0.5, 1] \end{cases} \quad \text{or} \quad \begin{matrix} NH_0: \mu \in [4, 5] \\ NH_a: \mu > 5 \end{matrix}$$

There exists two neutrosophic type of errors, they are:

5. A *Neutrosophic Type I Error*, is the error of rejecting NH_0 when NH_0 is true.
6. A *Neutrosophic Type II Error*, is the error of not rejecting NH_0 when NH_0 is false.

A *Neutrosophic Level of Significance* α can be a set, in this framework α can be defined like an interval.

A *Neutrosophic P-Value* p is the smallest level of significance such that NH_0 is rejected.

See that the Neutrosophic P-Value is not necessarily a crisp value.

The limits of the *Neutrosophic Confidence Interval for the Population Mean* μ is defined in Equation 1.

$$\bar{x} \pm z_{\text{critical value}} \cdot \frac{\hat{S}}{\sqrt{n}} \quad (1)$$

Where n is the sample size, which can be an interval, $\hat{S}$ is the sample standard deviation and $\bar{x}$ is the sample mean. Other approaches to neutrosophic distributions can be consulted in [22-24]. The hypothesis test can be naturally extended to neutrosophic hypothesis test. Also, normality tests can be applied, taking into account the new definitions.
A formula to calculate the statistically representative sample size is given in Equation 2.

$$n = \frac{k^2 Npq}{e^2(N-1)+k^2 pq} \quad (2)$$

Where:
n= sample size
N= population size.
p = probability that the event will occur (0.5).
q = probability that the event will not occur (0.5).
e = 0.05 or 5%. Maximum error accepted.
k = 1.96. For which the level of confidence is 95%.
Linguistic terms can be associated to SVNNs according to Table 1, defined in [25].

Linguistic Term	SVNN
Extremely good (EG)	(1,0,0)
Very very good (VVG)	(0.9, 0.1, 0.1)
Very good (VG)	(0.8,0.15,0.20)
Good(G)	(0.70,0.25,0.30)
Medium good (MDG)	(0.60,0.35,0.40)
Average(M)	(0.50,0.50,0.50)
Medium Bad (MDB)	(0.40,0.65,0.60)
Bad (B)	(0.30,0.75,0.70)
Very bad (VB)	(0.20,0.85,0.80)
Very very bad (VVB)	(0.10,0.90,0.90)
Extremely bad (EB)	(0,1,1)

Table 1: Linguistic terms and the associated SVNN, see [25].

The *Weighted Average* operator (WA), is an aggregation operator defined in Equation 3.

$$WA(a_1, a_2, \cdots, a_n) = \sum_{i=1}^{n} w_i a_i \quad (3)$$

Where, $a_i = (T_i, I_i, F_i)$ are SVNNs and $w_i \in [0, 1]$ for every i = 1, 2, …, n; which satisfy the condition $\sum_{i=1}^{n} w_i = 1$. The a_is are the values obtained for the i^{th} alternative assessment, and w_i denotes the weight which represents the importance given to the alternative a_i.

An adapted scoring function [26] is used to sort alternatives, see Equation 4.

$$s(a_j) = 2 + T_j - F_j - I_j \quad (4)$$

Here a_j is an alternative evaluated with the SVNN (T_j, I_j, F_j). Let us note that $s: [0,1]^3 \to [0,3]$.
The definition of precision function is given in Equation 5.

$$a(a_j) = T_j - F_j \quad (5)$$

See that $a: [0,1]^3 \to [-1, 1]$.

A poll shall help us to determine the main components of humanistic education, they are:

1. Teaching-learning environment
2. Role of the teacher and the student

3. Use of humanistic training in the exercise of the Law profession
4. Fundamental values that a legal professional must have

The procedure that shall be applied in this research is summarized in the following:

1. A group of teachers or experts of the Law School evaluate every one of the interviewed on the four precedent points, based on the linguistic terms in Table 1. The sample size of interviewed students is calculated with Equation 2.
2. For every interviewed student there exist four evaluations per expert according to the mentioned aspects. The equivalent SVNNs assessments are aggregated per expert using the weighted average aggregator with $w_1 = w_2 = w_3 = w_4 = 1/4$. Later the results are aggregated per student using the weighted average aggregator with $w_1 = w_2 = \ldots = w_n$, where n is the number of experts (teachers), preferably n = 3.
3. The value of the scoring function is calculated for every one of the precedent SVNNs. They form the sample set.
4. The normality of the sample is proved applying a test, e.g., Kolmogorov-Smirnov. In case the hypothesis of normality is rejected, then, if the sample size is bigger than 30, quasi-normality shall be assumed.
5. In this step many hypothesis test can be applied, for example: $\begin{cases} \mathrm{NH}_0: \mu \in [1.5, 3] \\ \mathrm{NH}_a: \mu < 1.5 \end{cases}$, taking into account that $s(1, 0, 0) = 3$ and $s(0.5, 0.5, 0.5) = 1.5$, see Equation 4, we are testing that the sample can be evaluated between "Average" and "Extremely good".

3 Results

To demonstrate the importance of humanistic and university education components in Law students, we obtained information from the initial analysis, focused on determining the population and sample to investigate. The study target group was the evening section of Law school students. Human resources, documents in general and written documents in particular were used, also infrastructure and, finally, research techniques and financial resources.

The sample investigated has as a common characteristic: the fact that they are all Law school students, presential mode, of the evening section of UNIANDES, Santo Domingo. For the gathering of field information, we used the poll to explore reality. The selection of the sample was made according to the objective of the research and its viability. In this sense the probabilistic criterion was assumed. We studied a population of 378 students from the evening section of the UNIANDES Law School, Santo Domingo; total respondents 191. This sample size was calculated applying Equation 2, where n = 190.78 ≈ 191.

Subsequently, the hypothesis of the importance of humanistic and university education components in Law students is demonstrated, to prove that the life of man will be better, insofar as it continuously fills his existence with meaning and meditation. For this, we used a neutrosophic hypothesis, which is a statement about the neutrosophic values of one or several characteristics of the population under study.

Next, second and third points of the procedure were applied. In the fourth point, according to the Kolmogorov-Smirnov proof, normality is rejected, nevertheless, we assume that the distribution is quasi-normal, because the n>>30.

Then, the following neurosophic hypothesis is study according to the fifth point:

$$\begin{cases} \mathrm{NH}_0: \mu \in [1.5, 3] \\ \mathrm{NH}_a: \mu < 1.5 \end{cases}$$

We have $\bar{x} = 1.2961$, $\hat{s} = 0.94697$, then, $z = \frac{\bar{x} - \mu}{\left(\hat{s}/\sqrt{n}\right)} = \frac{[1.2961, 1.2961] - [1.5, 3]}{\left(0.94697/\sqrt{191}\right)} = [-24.8671 \quad -2.9758] < -1.96.$

Therefore, the neutrosophic null hypothesis is rejected, which means that we expect the results of the population is qualified like under Average.

The result of the analysis of the components was alarming because of the low level of knowledge that Law school students have in terms of humanistic components and in particular, in the conception of integrality demanded by higher education, in order to distinguish the scope of both ethical and moral values, required from the individual perspective as university students, until their future professional life.

From the foregoing, the minimum values of importance given to humanistic education are inferred, as an indispensable component in the professional practice of Law, also expressing the low number of teachers who refer to this aspect. However, most of the students analyzed think it is necessary to receive talks that contribute to their humanistic education during the progress of their academic preparation.

The main reason for the low and very low level of knowledge, is enclosed in the lack of theoretical knowledge, caused by the little treatment that humanistic education gets in pre-university education, exposing also the need to attend to lectures, practical experiences, a greater participation of teachers and other actions that contribute to promoting this training within the teaching-learning process of the course.

On the other hand, the low levels of knowledge of the foundations of the humanistic education of Law students, are combined with a certain dissatisfaction as for the work of the university in this direction. Students express rational proposals on how to optimize humanistic education.

These results represent a confirmation of the theory of a holistic pedagogical process, according to which the

development of the legal culture of the graduate is provided by the entire educational process, the scientific and methodological level of teaching legal issues, as well as non-traditional ways and extracurricular and extracurricular work methods.

Responsibility outstands among the priority humanistic values Law students have. Most students define the responsibility as a concrete concept of the relationship between a person, a collective or society from the point of view of the conscious realization of the mutual demands that are presented to them.

Emphasis is also placed on honesty, procedural loyalty, among others, as fundamental values that a Law professional must have, according to the characteristics and content of the activities of the various professional participants in the judicial process.

To prove the importance of humanistic and university education components in law students, an experiment is carried out to analyze the aforementioned components, measuring the fundamental indicators in four groups of students with different levels of humanistic orientation.

- Group 1 (low level): students who lack a humanistic approach or are in the initial training stage, characterized by a vague idea of the humanistic aspect of the goals and objectives of the legal activity; indifferent attitude to their professional growth.
- Group 2 (low level) - students with low humanistic orientation, characterized by the understanding of certain aspects of the goals and objectives of the humanist plan and the weak expression of the humanistic motives of the activity. This group has attitudes towards the legal profession, but they show little independence and activity in the teaching process. The professional interests and inclinations of students in this category can be classified as inactive and unstable.
- Group 3 (middle level) - students, for whom a disrespectful attitude towards disciplines that are not part of professional training is possible. They show initiative and independence in the process of educational activity, they have firm attitudes toward the profession. The professional constancy in them is characterized by initiative, sustainability and efficiency, but with a small sample of creativity. They observe the comprehension and desire to achieve the basic humanistic goals and objectives in the learning process. They made a special emphasis on efficiency and purpose. The main socially motivated reasons are the desire to deeply dominate the profession and to achieve material welfare with its help. This group of students is characterized by an internal semantic aspiration to the appropriation of values in the process of cognition, activity and communication.
- Group 4 (high level) of students is characterized by the understanding and orientation towards the completion of humanistic ideas, the tasks of professional activity and a marked desire for their professional growth, self-development, and personal improvement. Very typical of them is the manifestation of initiative and independence, purpose and creativity. For this category of students, the presence of a positive ideal clearly defined is especially characteristic, which is, the idea of who or what their model will be for them. This group of students is characterized by an internal semantic aspiration to appropriation, the creation of values in the process of cognition, activity and communication.

In order to the results of the poll, we calculated that 28.206% of the respondents belong to Group 4, 27.713% belong to Group 3, 22.890% belong to Group 1 and 21.192% belong to Group 1. We expect that these percents are valid to the whole population with an error of ±5%.

4 Conclusions

In this study, we analyzed the humanistic and university education components in Law students, standing out the teaching-learning environment, the role of the teacher and the student, the use of humanistic training in the exercise of the legal profession and the fundamental values that a Law professional must have.

The effectiveness in the humanistic education of Law professionals is also analyzed, constituting this a point of reference to treat Law students. This efficiency is in accordance with the psychological and pedagogical conditions enclosed in the teaching - educational process of the university. It was included in the analysis of the humanistic components, the contents of the theoretical and practical-oriented courses, the introduction of humanistic approaches to teaching and the orientation of learning on the development of semantic values, the cooperation of teachers and students, the creation of individual trajectories of professional development for the students.

To demonstrate the significance that these components have in four groups of students with different characteristics, a neutrosophic hypothesis was used. Based on this, it was detected that a competency - oriented approach is necessary in the teaching - learning process of law students for the training of qualified personnel given the modern social conditions. The problem arises from the creation of general cultural competences and its important component.

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Received: January 29, 2019. Accepted: May 11, 2019

Abstract

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Papers in current issue (listed in papers' order):

Neutrosophic Triplet Group (revisited); Neutrosophic model to measure the impact of management projects on the process of pedagogical-research training; Neutrosophic statistics applied to the analysis of socially responsible participation in the community; Neutrosophic statistics methods applied to demonstrate the extra-contractual liability of the state from the Administrative Organic Code; Validation of the proof reversal on the inexistence of untimely dismissal by using neutrosophic IADOV technique; Compensatory fuzzy logic model for impact assessment when implementing ICT in pedagogical scenarios; Neutrosophic model for the analysis of criminal behaviour in Quevedo, Ecuador, from a spatial econometric analysis; Neutrosophic model to determine the degree of comprehension of higher education students in Ecuador; Pestel based on neutrosophic cognitive maps to characterize the factors that influence the consolidation of the neo constitutionalism in Ecuador; Softcomputing in neutrosophic linguistic modeling for the treatment of uncertainty in information retrieval; Use of neutrosophy for the detection of operational risk in corporate financial management for administrative excellence; Cased-based reasoning and neutrosophic logic to identify the employment limitations for Law school graduates at UNIANDES Ibarra; A Model of neutrosophic recommendation for the improvement of the consents of the ICSID arbitration procedure in Bolivia, Ecuador and Venezuela; Neutrosophic model based on the ideal distance to measure the strengthening of values in the students of Puyo university; Pestel analysis based on neutrosophic cognitive maps and neutrosophic numbers for the sinos river basin management; Prospective analysis of public management scenarios modeled by the Fuzzy Delphi method; Use of the Iadov method to measure the implementation of a program for sexual abuse prevention in Ecuador; Neutrosophic model for the analysis of the causes that lead to tax fraud ; Neutrosofic Iadov for the analysis of satisfaction on the regularities in the international legal field concerning the human rights of migrant workers in Ecuador; Neutrosophic model for the analysis of administrative offences on sexual abuse in the ecuadorian educational system; Use of neutrosophy for the analysis of the social reintegration factors of released prisoners in Ecuador; Use of Neutrosophy to analyze problems related to the joint custody of children and adolescents after marriage dissolution; Use of Neutrosophy to recommend conceptions related to the integral protection of the right to life ; Use of the neutrosophic IADOV technique to diagnose the real state of citizen participation and social control, exercised by young people in Ecuador; Neutrosofic statistics applied to demonstrate the importance of humanistic and higher education components in students of legal careers

Recently, NSS was also approved for Emerging Sources Citation Index (ESCI) available on the Web of Science platform, starting with Vol. 15, 2017.

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ISBN 978-1-59973-622-8

$39.95