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Neutrosophic Multicriteria Methods and PESTEL Analysis for the Evaluation of Informal Trade Impact

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Abstract: In towns where social phenomena such as poverty, migration and unemployment prevail, the informal market acquires special relevance, as is the case in Ecuador. The country has currently experienced a rise in this market, for example in the province of Pastaza, City of Puyo, where the Mariscal Market is located. In this market, most people are engaged in informal trade. A situation that has a negative impact on the economy and therefore requires an analysis which, due to the nature of the phenomenon, requires the intervention of multicriteria methods for its evaluation and decision-making. That is why this research aims to evaluate the negative impacts of informal trade related to the Mariscal de Puyo Market to offer strategies for the Government's decision-making process. In order to select the best strategies to determine a path to follow, we used the technique called neutrosophic TOPSIS enriched with the application of the neutrosophic AHP Saaty and PESTEL. The paper ends with conclusions on the strategies to follow to mitigate the negative impacts of informal trade in this region.

Keywords: impact, informal trade, neutrosophic TOPSIS, neutrosophic AHP Saaty, PESTEL

1. Introduction

All over the world, commerce is characterized by its versatility. That is why the mercantile society and the diverse social strata are directly related to the levels of trade. At these levels, economic transactions take place, which can be formal or informal, regarding the development characteristics of the towns where they occur. Depending on it, one form prevails over another [1]. This informal market acquires special relevance in towns where social phenomena such as poverty, migration, and unemployment prevail. As is the case of Ecuador, where there has been a rise in this market at the current commercial situation in the country [2]. Until December 2019, 46.7% of the country's employees were in the informal sector of the economy and only eight months later, amid the consequences of a pandemic, the country still does not know the deterioration that this market would have had, whose figures are of concern at the regional level. The Ecuadorian Institute of Statistics and Censuses (INEC) released the following data [2, 3] that illustrate the current situation that Ecuador is going through:

- The country's unemployment rate grew from 3.8% to 13.3% after the health crisis caused by Covid-19.
- In September 2020, 32.1% of workers in Ecuador had a suitable job, according to the latest figures from the National Survey of Employment, Unemployment, and Underemployment (Enemdu)[3].
- On October 15, the last National Survey of Employment, Unemployment, and Underemployment stated that one of the data that shows the deterioration of the labor market due to the economic crisis is that of informality. In September 2020, 48.6% of people with a job were working in the informal sector of the economy, which means that five out of 10 people with adequate or inadequate employment are working in "companies that are not incorporated in society",
- The job insecurity that Ecuador is experiencing has the informal employment as an output, mostly due to restrictions, which do not allow to enjoy better working conditions or access credit for businesses or better direct public policies.

Figure 1. Percentage change in the informal employment rate from 2001 to 2019. Source: [2]

The loss of jobs in year-on-year terms turns into an increase in people who are unemployed or have an inappropriate job. The unemployment rate in one year went from 4.9% in September 2019, which meant 406,871 people, to 6.6% in the same month of 2020, which represents more than 522,620 citizens. The population group hardest hit by unemployment is that of women, because according to the INEC, the unemployment rate was 8% for women, while in the case of men it was only 5.7%[3]. The reality in numbers does not reflect the increase in the migration of people from formality to the informal market. It does not provide the authorities with many decision tools, which is detrimental to economically active people, since the government, not being accurately informed about this phenomenon, can't properly plan the economy[4].

This situation takes place in the province of Pastaza, City of Puyo, where the Mariscal Market is located. In this market, most people are engaged in informal trade. Activity that is evident due to the increase in people who offer necessities in the streets surrounding the market. This implies competition in unfavorable conditions for those who carry out commercial activity in an orderly way and with the consequent payment of taxes, permits, rental fees, employees, and the risk of losing capital. A situation that has a negative impact on the economy and therefore requires an analysis which, due to the nature of the phenomenon, involves the intervention of multicriteria methods for its evaluation and decision-making.

According to the aforesaid, the objective of this paper is to evaluate the negative impacts of informal trade related to the Mariscal de Puyo Market in order to offer strategies for the Government's decision-making process. To select the best strategies to determine a path to follow, we used the technique called TOPSIS (Technique for Order Preference by Similarity to Ideal Solution). This technique is characterized by its effectiveness and the simplicity of its principle in solving multicriteria decision problems. To enrich this technique, the AHP (Hierarchical Analysis Process) is applied in its neutrosophic version and also the PESTEL method. The latter is a strategic analysis to determine the external environment that affects the following factors, namely, political, economic, sociocultural, technological, ecological, and legal, which allows the design of strategies to defend, take advantage of or adapt to anything that affects the sector [5].

Neutrosophy is the branch of philosophy that studies the origin, nature and scope of neutralities. Logic and neutrosophic sets constitute generalizations of Zadeh's logic and fuzzy sets of Atanassov's intuitionist logic. The incorporation of the neutrosophic sets in AHP Saaty and TOPSIS guarantees that the uncertainty of decision making is taken into account, including indeterminacies. In both techniques, the experts will evaluate in linguistic and not numerical terms, which constitutes the most natural form of measurement for humans.[6-19]. From now on, the document will consist of several sections where we will be presenting the materials and methods, results and discussion, and finally, the conclusions reached. For the resolution of the mathematical exercise, the information will be processed as follows:

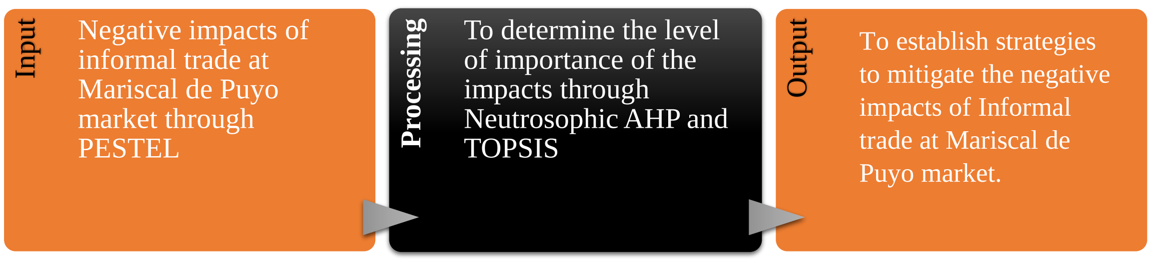

Figure 2. Process approach for the resolution of the exercise.

2 Materials and methods

A multicriteria decision problem starts from the evaluation given by a group of experts on the subject, around a set of alternatives on certain criteria. The problem is to find the best-evaluated alternative. The following section describes the methods used throughout the current investigation to meet the specific objectives set. The methods used are listed below:

PESTEL:

It is a strategic analysis technique to determine the external environment that affects the following factors, namely, political, economic, sociocultural, technological, ecological, and legal. It consists of determining the forces that affect the specific environment: sector, job market, target groups, competition, among others. It is a technique to analyze a business that allows and determines the context in which it operates, and at the same time, it allows the design of strategies to defend itself, takes advantage of, or adapt to anything that affects the sector [5, 20-22].

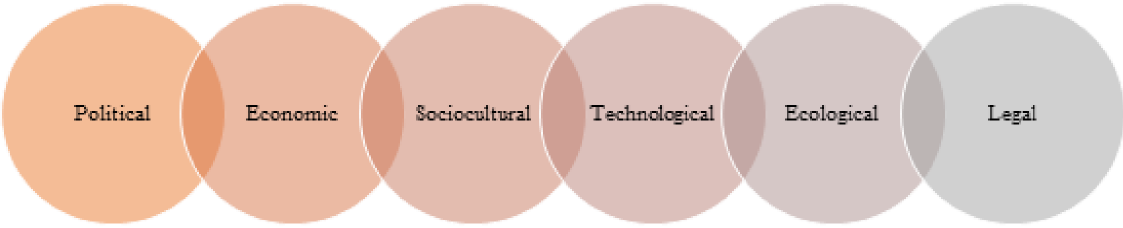

Figure 3. Dimensions of the PESTEL analysis.

AHP Saaty Neutrosophic:

Analytic Hierarchy Process (AHP Saaty): it was proposed by Thomas Saaty in 1980 [23]. It is one of the most widespread methods for solving multicriteria decision-making problems. This technique models the problem that leads to the formation of a representative hierarchy of the associated decision-making scheme. This hierarchy presents at the upper level the objective pursued in the solution of the problem and at the lower level, the different alternatives are included from which a decision must be made. The intermediate levels detail the set of criteria and attributes considered [24-36].

For the description of the method, the following definitions must be presented:

Definition 1: ([37, 38]) The *Neutrosophic set* N is characterized by three membership functions, which are the truth-membership function T_A, indeterminacy-membership function I_A, and falsehood-membership function F_A, where U is the Universe of Discourse and $\forall x \in U$, $T_A(x), I_A(x), F_A(x) \subseteq]^-0, 1^+[$, and $^-0 \leq \inf T_A(x) + \inf I_A(x) + \inf F_A(x) \leq \sup T_A(x) + \sup I_A(x) + \sup F_A(x) \leq 3^+$. Notice that, according to the definition, $T_A(x)$, $I_A(x)$ and $F_A(x)$ are real standard or non-standard subsets of $]^-0, 1^+[$ and hence, $T_A(x)$, $I_A(x)$ and $F_A(x)$ can be subintervals of [0, 1].

Definition 2: ([37, 38]) The *Single-Valued Neutrosophic Set* (SVNS) N over U is A = [39], where $T_A: U \rightarrow [0, 1]$, $I_A: U \rightarrow [0, 1]$, and $F_A: U \rightarrow [0, 1]$, $0 \leq T_A(x) + I_A(x) + F_A(x) \leq 3$. The *Single-Valued Neutrosophic Number* (SVNN) is represented by N = (t, I, f), such that $0 \leq t, I, f \leq 1$ and $0 \leq t + I + f \leq 3$.

Definition 3: ([37, 38, 40, 41]) the *single-valued trapezoidal neutrosophic number*, $\tilde{a} = \langle (a_1, a_2. a_3, a_4); \alpha_{\tilde{a}}, \beta_{\tilde{a}}, \gamma_{\tilde{a}} \rangle$, is a neutrosophic set on $\mathbb{R}$, whose truth, indeterminacy and falsehood membership functions are defined as follows, respectively:

$$T_{\tilde{a}}(x) = \begin{cases} \alpha_{\tilde{a}}\left(\frac{x-a_1}{a_2-a_1}\right), & a_1 \leq x \leq a_2 \\ \alpha_{\tilde{a}}, & a_2 \leq x \leq a_3 \\ \alpha_{\tilde{a}}\left(\frac{a_3-x}{a_3-a_2}\right), & a_3 \leq x \leq a_4 \\ 0, \text{ otherwise} & \end{cases} \tag{1}$$

$$I_{\tilde{a}}(x) = \begin{cases} \frac{(a_2-x+\beta_{\tilde{a}}(x-a_1))}{a_2-a_1}, & a_1 \leq x \leq a_2 \\ \beta_{\tilde{a}}, & a_2 \leq x \leq a_3 \\ \frac{(x-a_2+\beta_{\tilde{a}}(a_3-x))}{a_3-a_2}, & a_3 \leq x \leq a_4 \\ 1, & \text{otherwise} \end{cases} \tag{2}$$

$$F_{\tilde{a}}(x) = \begin{cases} \frac{(a_2-x+\gamma_{\tilde{a}}(x-a_1))}{a_2-a_1}, & a_1 \leq x \leq a_2 \\ \gamma_{\tilde{a}}, & a_2 \leq x \leq a_3 \\ \frac{(x-a_2+\gamma_{\tilde{a}}(a_3-x))}{a_3-a_2}, & a_3 \leq x \leq a_4 \\ 1, & \text{otherwise} \end{cases} \tag{3}$$

Where, $\alpha_{\tilde{a}}, \beta_{\tilde{a}}, \gamma_{\tilde{a}} \in [0,1]$ $a_1, a_2, a_3, a_4 \in \mathbb{R} a_1 \leq a_2 \leq a_3 \leq a_4$

Definition 4: ([37, 38, 40, 41]) given $\tilde{a} = \langle(a_1, a_2, a_3, a_4); \alpha_{\tilde{a}}, \beta_{\tilde{a}}, \gamma_{\tilde{a}}\rangle$ and $\tilde{b} = \langle(b_1, b_2, b_3, b_4); \alpha_{\tilde{b}}, \beta_{\tilde{b}}, \gamma_{\tilde{b}}\rangle$ two single-valued trapezoidal neutrosophic numbers and λ any non-null number in the real line. Then, the following operations are defined:

Addition: $\tilde{a} + \tilde{b} = \langle(a_1 + b_1, a_2 + b_2, a_3 + b_3, a_4 + b_4); \alpha_{\tilde{a}} \wedge \alpha_{\tilde{b}}, \beta_{\tilde{a}} \vee \beta_{\tilde{b}}, \gamma_{\tilde{a}} \vee \gamma_{\tilde{b}}\rangle$

Subtraction: (4)$\tilde{a} - \tilde{b} = \langle(a_1 - b_4, a_2 - b_3, a_3 - b_2, a_4 - b_1); \alpha_{\tilde{a}} \wedge \alpha_{\tilde{b}}, \beta_{\tilde{a}} \vee \beta_{\tilde{b}}, \gamma_{\tilde{a}} \vee \gamma_{\tilde{b}}\rangle$

Inversion: $\tilde{a}^{-1} = \langle({a_4}^{-1}, {a_3}^{-1}, {a_2}^{-1}, {a_1}^{-1}); \alpha_{\tilde{a}}, \beta_{\tilde{a}}, \gamma_{\tilde{a}}\rangle$ where $a_1, a_2, a_3, a_4 \neq 0$

Multiplication by a scalar number:

$$\lambda\tilde{a} = \begin{cases} \langle(\lambda a_1, \lambda a_2, \lambda a_3, \lambda a_4); \alpha_{\tilde{a}}, \beta_{\tilde{a}}, \gamma_{\tilde{a}}\rangle, & \lambda > 0 \\ \langle(\lambda a_4, \lambda a_3, \lambda a_2, \lambda a_1); \alpha_{\tilde{a}}, \beta_{\tilde{a}}, \gamma_{\tilde{a}}\rangle, & \lambda < 0 \end{cases}$$

Definitions 3 and 4 refer to single-valued triangular neutrosophic number when the condition $a_2 = a_3$, [42-44]. For simplicity, we use the linguistic scale of triangular neutrosophic numbers (see Table 1 and compare it with the scale defined in [45]. The hierarchical analytical process was proposed by Thomas Saaty in 1980 [23]. This technique models the problem that leads to the formation of a hierarchy representative of the associated decision-making scheme [24, 25]. The formulation of the decision-making problem in a hierarchical structure is the first and main stage. This stage is where the decision-maker must break down the problem into its relevant components[46], [47, 48]. The hierarchy is constructed so that the elements are of the same order of magnitude and can be related to some of the next levels. In a typical hierarchy, the highest level locates the problem of decision-making. The elements that affect decision-making are represented at the intermediate level, the criteria occupying the intermediate levels. At the lowest level, the decision options are placed [49]. The levels of importance or weighting of the criteria are estimated using paired comparisons between them. This comparison is carried out using a scale, as expressed in equation (6) [50].

$$S = \left\{\frac{1}{9}, \frac{1}{7}, \frac{1}{5}, \frac{1}{3}, 1,3,5,7,9\right\} \quad (5)$$

We can find in [45] the theory of the AHP technique in a neutrosophic framework. Thus, we can model the indeterminacy of decision-making by applying neutrosophic AHP or NAHP for short. Equation 7 contains a generic neutrosophic pair-wise comparison matrix for NAHP.

$$\tilde{A} = \begin{bmatrix} \tilde{1} & \tilde{a}_{12} & \cdots & \tilde{a}_{1n} \\ \vdots & & \ddots & \vdots \\ \tilde{a}_{n1} & \tilde{a}_{n2} & \cdots & \tilde{1} \end{bmatrix} \quad (6)$$

Matrix $\tilde{A}$ must satisfy condition $\tilde{a}_{ji} = \tilde{a}_{ij}^{-1}$, based on the inversion operator of Definition 4.

To convert neutrosophic triangular numbers into crisp numbers, there are two indexes defined in [45]. They are the so-called score and accuracy indexes, respectively, see Equations 8 and 9:

$$S(\tilde{a}) = \frac{1}{8}[a_1 + a_2 + a_3](2 + \alpha_{\tilde{a}} - \beta_{\tilde{a}} - \gamma_{\tilde{a}}) \quad (7)$$

$$A(\tilde{a}) = \frac{1}{8}[a_1 + a_2 + a_3](2 + \alpha_{\tilde{a}} - \beta_{\tilde{a}} + \gamma_{\tilde{a}}) \quad (8)$$

Saaty's scale	Definition	Neutrosophic Triangular Scale
1	Equally influential	$\tilde{1} = \langle(1,1,1); 0.50, 0.50, 0.50\rangle$
3	Slightly influential	$\tilde{3} = \langle(2,3,4); 0.30, 0.75, 0.70\rangle$
5	Strongly influential	$\tilde{5} = \langle(4,5,6); 0.80, 0.15, 0.20\rangle$
7	Very strongly influential	$\tilde{7} = \langle(6,7,8); 0.90, 0.10, 0.10\rangle$
9	Absolutely influential	$\tilde{9} = \langle(9,9,9); 1.00, 1.00, 1.00\rangle$
2, 4, 6, 8	Sporadic values between two close scales	$\tilde{2} = \langle(1,2,3); 0.40, 0.65, 0.60\rangle$
		$\tilde{4} = \langle(3,4,5); 0.60, 0.35, 0.40\rangle$
		$\tilde{6} = \langle(5,6,7); 0.70, 0.25, 0.30\rangle$
		$\tilde{8} = \langle(7,8,9); 0.85, 0.10, 0.15\rangle$

Table 1. Saaty's scale translated to a neutrosophic triangular scale.

Step 1 Select a group of experts.

Step 2 Structure the neutrosophic pair-wise comparison matrix of factors, sub-factors, and strategies, through the linguistic terms shown in Table 1.

The neutrosophic scale is attained according to expert opinions[51]. The neutrosophic pair-wise comparison matrix of factors, sub-factors, and strategies are as described in Equation 6.

Step 3 Check the consistency of experts' judgments.

If the pair-wise comparison matrix has a transitive relation, i.e., $a_{ik} = a_{ij}a_{jk}$ for all i,j, and k, then the comparison matrix is consistent, focusing only on the lower, median, and upper values of the triangular neutrosophic number of the comparison matrix.

Step 4. Calculate the weight of the factors from the neutrosophic pair-wise comparison matrix, by transforming it to a deterministic matrix using Equations 9 and 10. To get the score and the accuracy degree of $\tilde{a}_{ji}$ the following equations are used:

$$S(\tilde{a}_{ji}) = 1/S(\tilde{a}_{ij}) \tag{9}$$

$$A(\tilde{a}_{ji}) = 1/A(\tilde{a}_{ij}) \tag{10}$$

With compensation by accuracy degree of each triangular neutrosophic number in the neutrosophic pair-wise comparison matrix, we derive the following deterministic matrix:

$$A = \begin{bmatrix} 1 & a_{12} & \cdots & a_{1n} \\ \vdots & & \ddots & \vdots \\ a_{n1} & a_{n2} & \cdots & 1 \end{bmatrix} \tag{11}$$

Determine the ranking of priorities, namely the Eigen Vector X, from the previous matrix:

1. Normalize the column entries by dividing each entry by the sum of the column.
2. Take the total of the row averages.

Note that Step 3 refers to consider the use of the calculus of the Consistency Index (CI) when applying this technique, which is a function depending on λ_{max}, the maximum eigenvalue of the matrix. Saaty establishes that consistency of the evaluations can be determined by the equation:

$$CI = \frac{\lambda_{max} - n}{n-1} \text{ [52]}, \tag{12}$$

where n is the order of the matrix. In addition, the Consistency Ratio (CR) is defined by equation:

$$CR = \frac{CI}{RI} \tag{13}$$

RI is given in Table 2.

Order (n)	1	2	3	4	5	6	7	8	9	10
RI	0	0	0.52	0.89	1.11	1.25	1.35	1.40	1.45	1.49

Table 2. RI associated with every order.

If CR≤0.1 we may consider that experts' evaluation is sufficiently consistent and hence we can proceed to use NAHP. We apply this procedure to matrix "*A*" in Equation 12.

TOPSIS

In the case of TOPSIS, the selection is based on finding the alternative that is closest to the ideal solution and in turn moves further away to the worst solution. It was developed by Hwang and Yoon in 1981 and is based on the concept that a given alternative should be located at the shortest distance from an ideal alternative that represents the best (positive ideal or simply ideal), and at the greatest distance from an ideal alternative that represents the worst (negative ideal or anti-ideal) [53-60]. This method had its evolution towards Neutrosophy, so in this paper, linguistic terms will be associated with Single-Valued Neutrosophic Numbers (SVNN), so that experts can carry out their assessments in linguistic terms, which is more natural. Therefore, the scales shown in Table 3 will be taken into account.

Linguistic term	SVNN
Very Important (VI)	(0.9, 0.1, 0.1)
Important (I)	(0.75,0.25,0.20)
Medium (M)	(0.50,0.50,0.50)
Not Important (NI)	(0.35,0.75,0.80)
Very Not Important (NVI)	(0.10,0.90,0.90)

Table 3. Linguistic terms represent the evaluation of the criteria in the alternatives.

The TOPSIS method for SVNN consists of the following, assuming that A={ρ_1,ρ_2,…,ρ_m } is a set of alternatives and G={β_1,β_2,…,β_n } is a set of criteria, where the following steps will be carried out:

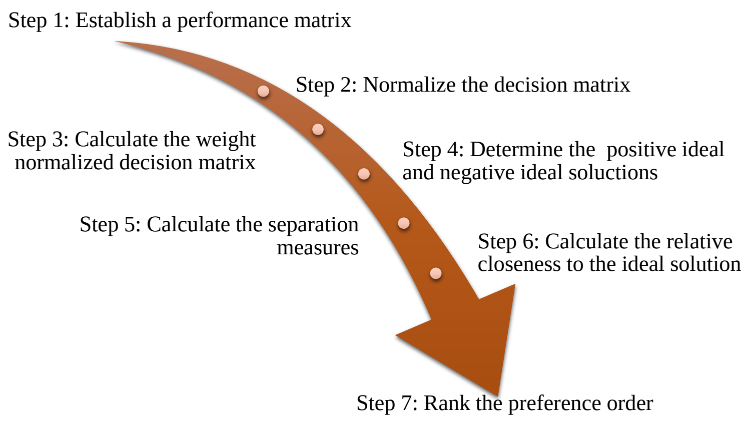

Figure 4. TOPSIS steps.

Step 1: Establish a performance matrix

In this step, we proceed to the construction of the neutrosophic decision matrix of aggregated unique values. Which is used to aggregate all individual evaluations. Each d_{ij} is calculated as the aggregation of the evaluations given by each expert $\left(u_{ij}^t, r_{ij}^t, v_{ij}^t\right)$ using the weights of the AHP Saaty of each criterion with the help of equations 7 and 8 and tables 1 and 2. In this way, a matrix D = $(d_{ij})_{ij}$ is obtained, where each d_{ij} is a SVNN (i = 1,2, .., m; j = 1,2,…, n).

Step 2: Normalize the decision matrix

Suppose that the weight of each criterion is given by W = (w_1, w_2,…, w_n), where w_j denotes the relative importance of criterion w_j. If $w_j^t = (a_j^t, b_j^t, c_j^t)$ is the evaluation of criterion w_j by the t-th expert. Then Equation 13 is used to add the w_j^t with the weights. The construction of the normalized matrix will be as follows:

$$w_{ij} = \frac{f_{ij}}{\sqrt{\sum_{j=1}^{n} f_{ij}^2}} \quad (14)$$

Where: wij is the normalized value for the qualification of alternative i against criterion j and f_{ij} is the indicator of each alternative i against each indicator j.

Step 3: Calculate the weight normalized decision matrix

We proceed to the construction of the neutrosophic decision matrix of the single values weighted mean with respect to the criteria.

$$D^* = D*W, \text{ where } d_{ij}^* = w_j * d_{ij} = (a_{ij}, b_{ij}, c_{ij}) \quad (15)$$

Step 4: *Determine the positive ideal and negative ideal solutions*

$$s^+ = (x_1^+, x_2^+, \dots x_{j+l}^+) \text{ that is to say,} s_i^+ = \left(\frac{1}{3}\sum_{j=1}^{n}\left\{\left(a_{ij} - a_j^+\right)^2 + \left(b_{ij} - b_j^+\right)^2 + \left(c_{ij} - c_j^+\right)^2\right\}\right)^{\frac{1}{2}} \quad (16)$$

$$s^- = (x_1^-, x_2^-, \dots x_{j+l}^-) \text{ that is to say,} s_i^- = \left(\frac{1}{3}\sum_{j=1}^{n}\left\{\left(a_{ij} - a_j^-\right)^2 + \left(b_{ij} - b_j^-\right)^2 + \left(c_{ij} - c_j^-\right)^2\right\}\right)^{\frac{1}{2}} \quad (17)$$

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

$$\rho(A^k, A^+) = \|w * (TA^k - TA^+)\| \quad (18)$$
$$\rho(A^k, A^-) = \|w * (TA^k - TA^-)\| \quad (19)$$

Step 6: Calculate the relative closeness to the ideal solution

To calculate the Relative Proximity Index (Ri), it is done as follows: the proximity coefficient of each alternative is calculated concerning the positive and negative ideal solutions.

$$Ri(A^k, A^i) = \frac{\rho(A^k, A^+)}{\rho(A^k, A^+) + \rho(A^k, A^-)} \quad (20)$$

Step 7: Rank the preference order

The alternatives are ordered from highest to lowest, under the condition that Ri→1 is the optimal solution.

3 RESULTS

In the following section, we preferred to start with the establishment of the negative impacts caused by the rise of informal trade in the specific region of the Mariscal de Puyo market. Which will be exposed by the PESTEL technique as follows:

Political

- Little control by the authorities, sistematically failing to comply with current regulations on the use of public space, commerce and tax legistation.

Economic

- Survival economy: employees survive on precarious and informal jobs
- It imposes a reduction in hours and wages.
- It does not aim efforts towards an adecuate formalization of the company, the nation remains excent from receiving the economic contributions from the taxes that legally must have been reported.
- Puts the formalized sector at a competitive disadvantage, being them who are subject to laws, regulations, rules and agreements that bring along a tax payment responsability.

Social

- People get used to buying cheap products without worrying about its legal origin.
- Not being used to formal working hours, which leads to a trend of not to apply for formal jobs.
- Invasion of public and private space.
- Riots between mechants arguing about space, prices, offers.

Technological

- No impacts are detected in this regard.

Ecological

- They ilegally sell products that are usually comming from not eco-friendly sources.
- They don't opt for products certified with environmental labels.

Legal

- They offer similar products to the pedestrians, occupying the public space and not respecting the legal right to purchase.
- Informal and non-contractual relations between employers and employees without any social segurity or legal support.
- They are not supported by any documents, so profit margin might be increased.

Figure 5. Impacts caused by informal trade in the Mariscal de Puyo market.

To continue with the analysis, the experts who will take part in the team for the evaluation of the impacts will be determined using the AHP Saaty and TOPSIS multicriteria techniques:

- Formal and informal market traders
- Neighbors of the area
- Local government officials

We proceed to verify whether we are in the presence of an uncertainty problem. For this, the following is established: Set of criteria: $C = \{c_1 \dots c_8\}; m \geq 1; \forall Cm \notin \emptyset, 1 \leq m \leq 6$; Expert set: $E = \{e_1 \dots e_{12}\}; n \geq 1; \forall Em \notin \emptyset, 1 \leq m \leq 58$; Set of alternatives: $A = \{a_1 \dots a_{12}\}; k \geq 1; \forall Ak \notin \emptyset, 1 \leq k \leq 6$. This verifies the need for the interaction of neutrosophy as a science that studies the indeterminacies that may exist in these cases. Then it leads to the execution of multicriteria techniques from the neutrosophic perspective.

Neutrosophic AHP Saaty to determine weights of the criteria on which the experts will be based to evaluate the alternatives of primary indicators:

Criteria	Product or service	Business location	Origin of the business	Areas covered	Predominant gender	Stay time
Product or service	1	⟨(6,7,8); 0.90,0.10,0.10⟩	⟨(6,7,8); 0.90,0.10,0.10⟩	⟨(6,7,8); 0.90,0.10,0.10⟩	⟨(7,8,9); 0.85,0.10,0.15⟩	⟨(5,6,7); 0.70,0.25,0.30⟩
Business location	$\tilde{7}$	1	⟨(2,3,4); 0.30,0.75,0.70⟩	⟨(4,5,6); 0.80,0.15,0.20⟩	⟨(3,4,5); 0.60,0.35,0.40⟩	⟨(6,7,8); 0.90,0.10,0.10⟩

Origin of the business	$\tilde{7}$	$\tilde{3}$	1	⟨(2,3,4); 0.30,0.75,0.70⟩	⟨(2,3,4); 0.30,0.75,0.70⟩	⟨(2,3,4); 0.30,0.75,0.70⟩
Areas covered	$\tilde{7}$	$\tilde{5}$	$\tilde{3}$	1	⟨(1,1,1); 0.50,0.50,0.50⟩	⟨(2,3,4); 0.30,0.75,0.70⟩
Predominant gender	$\tilde{8}$	$\tilde{4}$	$\tilde{3}$	$\tilde{1}$	1	⟨(1,1,1); 0.50,0.50,0.50⟩
Stay time	$\tilde{6}$	$\tilde{7}$	$\tilde{3}$	$\tilde{3}$	$\tilde{1}$	1

Table 4. Paired matrix Neutrosophic AHP Saaty.

Criteria	**Product or service**	**Business location**	**Origin of the business**	**Areas covered**	**Predominant gender**	**Stay time**	**WEIGHT**	**Ax Weight**	**Approx. Eigenvalues**
Product or service	0.60	0.79	0.62	0.42	0.48	0.30	0.5138	3.92	7.6322
Business location	0.08	0.10	0.21	0.30	0.22	0.37	0.2148	1.46	6.7752
Origin of the business	0.08	0.04	0.08	0.14	0.14	0.12	0.1143	0.73	6.3841
Areas covered	0.08	0.02	0.03	0.06	0.05	0.12	0.0648	0.40	6.1512
Predominant gender	0.07	0.03	0.03	0.06	0.05	0.05	0.0482	0.31	6.4916
Stay time	0.10	0.01	0.03	0.02	0.06	0.05	0.0438	0.27	6.1158

Table 5. Determination of criteria weights applying the Neutrosophic AHP method.

The analysis of the consistency of the method showed that its own value is 6.59171, IC = 0.12, and RC = 0.09, so it is confirmed that the exercise was correct.

Neutrosophic TOPSIS

Alternatives / Criteria	**Product or service**	**Business location**	**Origin of the business**	**Areas covered**	**Predominant gender**	**Stay time**
P	(0.75,0.25,0.20)	(0.75,0.25,0.20)	(0.75,0.25,0.20)	(0.75,0.25,0.20)	(0.75,0.25,0.20)	(0.75,0.25,0.20)
E	(0.9, 0.1, 0.1)	(0.9, 0.1, 0.1)	(0.9, 0.1, 0.1)	(0.9, 0.1, 0.1)	(0.9, 0.1, 0.1)	(0.9, 0.1, 0.1)
S	(0.9, 0.1, 0.1)	(0.75,0.25,0.20)	(0.9, 0.1, 0.1)	(0.9, 0.1, 0.1)	(0.75,0.25,0.20)	(0.9, 0.1, 0.1)
T	(0.35,0.75,0.80)	(0.35,0.75,0.80)	(0.35,0.75,0.80)	(0.35,0.75,0.80)	(0.35,0.75,0.80)	(0.35,0.75,0.80)
E	(0.50,0.50,0.50)	(0.50,0.50,0.50)	(0.50,0.50,0.50)	(0.50,0.50,0.50)	(0.50,0.50,0.50)	(0.50,0.50,0.50)
L	(0.9, 0.1, 0.1)	(0.75,0.25,0.20)	(0.75,0.25,0.20)	(0.9, 0.1, 0.1)	(0.75,0.25,0.20)	(0.9, 0.1, 0.1)

Table 6. Performance matrix

Alternatives/ Criteria	**Product or service**	**Business location**	**Origin of the business**	**Areas covered**	**Predominant gender**	**Stay time**	**D +**	**D-**	**Ri**	**Hierarchy order**
P	0.420	0.494	0.404	0.456	0.491	0.438	0.029	0.100	0.772	4
E	0.489	0.420	0.505	0.485	0.427	0.487	0	0.130	1	1
S	0.489	0.525	0.505	0.485	0.534	0.487	0.008	0.128	0.938	2
T	0.195	0.210	0.202	0.097	0.106	0.097	0.128	0.001	0.013	6
E	0.274	0.284	0.262	0.291	0.309	0.292	0.094	0.035	0.272	5
L	0.479	0.420	0.464	0.475	0.427	0.487	0.009	0.124	0.929	3
Weights	0.489	0.525	0.505	0.485	0.534	0.487	// ////			

Table 7. Weighted normalized matrix, Proximity calculation relative to the ideal solution, and hierarchical order

Conclusions

Informal trade in Ecuador is in a boom at an economic-social level that is currently being promoted by the situation of poverty in which the country is submerged. This implies that the activities carried out by informal traders are exponentially strengthened since the activity will continue to rise as long as there is a demand from the population. Traders start with the objective of generating resources and profitability that allow them to mobilize resources and have a favorable flow of money for them, but they end up causing negative impacts in the places where they take place. This is why the evaluation is necessary, which presents the following main results:

- The PESTEL analysis shows that there is a prevalence in the existence of negative impacts due to the growing informal trade in this locality. Despite the benefit that many people who work in it may obtain. The external view provided by the technique shows that both the economic and social aspects are substantially suffering because of this situation.
- We found that the criteria by which informal markets are governed and established are the following: product or service in high demand, location of the business in public spaces, the non-legal origin of the business, which presupposes a low initial investment cost, areas covered or extent achieved by the merchant, predominant gender, length of stay. With the proper development of these factors, informal merchants achieve an exponential impact as they achieve competitiveness, strategic and operational management.
- The experts consistently agreed that each of these criteria or factors is taken into account for the establishment of businesses, and that is why they cause the greatest impact within their successful development. Thus, if you want to reduce this rise in the informal market, you must initially establish policies and/or actions to regulate the variables of product or service offer, the location of the business, and its legal origin.
- The modeling through the application of the neutrosophic TOPSIS showed that the previous criteria mainly enhance the economic, social, legal, political, ecological impacts and finally, the technological ones where they do not have any incidence. Therefore, economic social strategies must be drawn up, with legal and political support, such as those proposed below:
  - Increased control by the authorities is needed.
  - In the Mariscal Market, coordinated actions must be taken so that merchants limit their aspirations to carry out illegal activity, as well as to minimize social mobility and include corrective measures and support for the informal sector in zonal planning.
  - Local authorities must carry out joint activities to deal with the problem and develop a plan that allows for the socialization of established public policies and the benefits they can have in informal trade.
  - Carry out socialization processes that limit the purchase to sellers who do not have identification as well as to reformulate the ordinance of use of public space.

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