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## Neutrosophic Insights into Strategic Decision-Making: Navigating Complexity in Ecuadorian Business Management

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### Abstract

Strategic decision-making in Ecuadorian business management is subject to multifaceted complexity, marked by variability in the influence of internal and external factors. Under a neutrosophic approach, the indeterminacies surrounding these processes are explored, with the overall goal of assessing strategic decision-making for inclusion in the dynamic business environment. The results indicate the necessity of recognizing and incorporating indeterminacies into the changing dynamics of business activity. The conclusions underscore the need for adaptable and resilient strategies that adjust to the variability in the influence of internal and external factors in business management.

**Keywords:** Business Management, Regulation, Internal and External Factors.

## 1 | Introduction

Strategic decision-making is the fundamental process in business management that sets the course for a company and its ability to compete in a constantly changing market [1]. It involves evaluating alternatives and choosing a course of action that would impact the company's long-term position [2]. This process is a combination of analysis, anticipation, and judgment, essential for achieving the goals and vision of a company. In other words, it involves the formulation and implementation of plans and actions that make the most of the company's resources to reach its objectives [3]. This includes assessing internal and external environments, setting goals, identifying options, and selecting a path forward.

Strategic decision-making in business management in Ecuador faces several challenges, including a lack of information [4], resources, and training in decision-making. To implement business strategies in Ecuador, the following options can be considered:

- Development of clean and sustainable technologies: Companies can explore clean and sustainable technologies to improve their environmental impact and reduce costs.



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- Establishing business strategies for SMEs in the context of the pandemic: SMEs can implement strategies to overcome the economic crisis in the nation. This includes organizational reinvention, transitioning from traditional marketing to digital marketing, and diversification in products and services, among others.
- Companies can diversify their operations and expand to other markets to reduce dependence on the local Ecuadorian market.

It is a fundamental process in business management to compete in the market. Therefore, the general objective of this study is to evaluate strategic decision-making in business management through an analysis composed of the neutrosophic methods PESTEL, Entropy, SMART, and ARAS. To achieve this, the following specific objectives must be defined:

- Identify and analyze the internal and external factors that affect strategic decision-making in business management.
- Evaluate the weights of neutrosophic importance of the criteria, internal and external factors, based on the proposed methods.
- Present proposals for solutions to mitigate the factors with the greatest weight of neutrosophic importance.

## 2 | Materials and Methods

### 2.1 | PESTEL

The PESTEL analysis is a strategic planning tool used to identify the environment in which the future project is designed in an organized and schematic manner. The strategic analysis determines the current situation of the organization to create strategies, seize opportunities, or respond to potential risks [5].

The application of neutrosophic aspects in PESTEL involves identifying and analyzing the external environment and subsequently strategically acting upon it, including the indeterminate elements of the analyzed set. This involves analyzing external factors associated with the political class that influence the future activities of the company and current and future economic issues affecting strategy execution. Simultaneously, the analysis of sociocultural factors helps identify current societal trends, the influence of new technologies, and potential future changes.

In addition, there is an examination of potential changes related to ecology and changes in legal regulations associated with the project, which can have positive or negative effects. For the study, each neutrosophic element is analyzed within the assigned dimension, incorporating indeterminacy into the analysis development according to the referenced methodology [6].

### 2.2 | Assessment using Single-Valued Neutrosophic Numbers (SVNN)

Each neutrosophic set (NS) is defined by neutrosophic variables within the range  $\{0,1\}$ . Each single-valued neutrosophic set  $Y$ , over  $X$  as the object in the representation  $Y = \{(x, \iota_y(x), \kappa_y(x), \lambda_y(x)) : x \in X\}$ , where it satisfies the following condition  $0 \leq \iota_y(x), \kappa_y(x), \lambda_y(x) \leq 3$  for all  $x \in X$ . So that  $\iota_y(x)$  for true elements,  $\kappa_y(x)$  for indeterminate elements, and  $\lambda_y(x)$  for false elements. Therefore, for the development of the study and the modeling of the proposed methods, each neutrosophic number is identified as  $V = (a, b, c)$ , where the conditions stated in the previous analysis are met. For the development of the method, it is necessary to define the neutrosophic scales according to the linguistic terms proposed in Tables 1 and 2.

**Table 1.** Linguistic terms that represent the neutrosophic weight of the criteria. Source: own elaboration.

Linguistic scale	SVNN
Very important	(0.91,0.15,0.11)

<b>Important</b>	(0.71,0.20,0.21)
<b>Relevant</b>	(0.51,0.55,0.51)
<b>Less important</b>	(0.31,0.80,0.81)
<b>Low importance</b>	(0.11,0.90,0.94)

**Table 2.** Linguistic terms that represent the neutrosophic weight of factors or criteria.

Linguistic term	SVNN
<b>Extremely good (EG)</b>	(1.00,0.00,0.00)
<b>Very very good (VVG)</b>	(0.94,0.11,0.12)
<b>Very good (VG)</b>	(0.84,0.21,0.22)
<b>Good (G)</b>	(0.74,0.31,0.32)
<b>Moderately good (MB)</b>	(0.64,0.41,0.42)
<b>Medium (M)</b>	(0.54,0.51,0.52)
<b>Moderately bad (MG)</b>	(0.44,0.61,0.62)
<b>Bad (B)</b>	(0.34,0.71,0.72)
<b>Very bad (VB)</b>	(0.24,0.81,0.82)
<b>Very very bad (VVB)</b>	(0.14,0.91,0.92)
<b>Extremely bad (EB)</b>	(0.00,0.95,1.00)

### 2.3 | Entropy and SVNN

Entropy is a multicriteria method that evaluates various criteria based on multiple alternatives. It includes indeterminacy as an essential part of the final result. It is developed by indicating a distribution with pronounced peaks [7]. Depending on the diversity in the evaluations (values) of the alternatives, greater importance should be given to that criterion in the final decision, as it has the power to discriminate between alternatives [8, 17]. The method measures and evaluates the diversity and indeterminacy of a criterion through entropy, which is why it is linked to neutrosophy through the Single Valued Neutrosophic Uncertain Numbers (SVNUN). The calculated entropy is higher when the evaluations of the considered alternatives are more similar. For the modeling of the neutrosophic entropy method, it is calculated in the following steps:

**Step 1.** Construction of the decision matrix.

**Step 2.** Calculation of the normalized decision matrix  $P_{ij}$ , the objective of normalization is to obtain dimensionless values of different criteria to make comparisons between them. It is calculated using Eq. (1).

$$P_{ij} = \frac{x_{ij}}{\sum_{i=1}^m x_{ij}} \tag{1}$$

**Step 3.** Calculation of entropy  $E_j$ , using Eq. (2).

$$E_j = -k \left( \sum_{i=1}^m P_{ij} \ln(p_{ij}) \right), \text{ where } t = 1, 2, 3, \dots, n. \tag{2}$$

Where  $k = \frac{1}{\ln m}$  is a constant that guarantees  $0 \leq E_j \leq 1$  and  $m$  is the number of alternatives.

**Step 4.** Calculation of criterion diversity  $D_j$ , Eq. (3) allows this parameter to be calculated.

$$D_j = 1 - E_j \tag{3}$$

**Step 5.** Calculation of the normalized weight  $W_j$  of each criterion, using Eq. (4).

$$W_j = \frac{D_j}{\sum_{i=1}^m D_j} \tag{4}$$

## 2.4 | Neutrosophic SMART

The Neutrosophic SMART method harmonizes the SMART methodology (Specific, Measurable, Achievable, Relevant, and Timely) with neutrosophy, integrating it to include the indeterminacy of information in the elements, objectives, alternatives, or solutions to be defined [9, 18]. The importance value of each alternative is obtained through the weighted algebraic mean of neutrosophic values. To determine a point within the neutrosophic set  $D(V)$  from a number  $(G)$ , the formula proposed by Smarandache is used, according to Eq. (5).

$$G(V) = a + c - b \quad (5)$$

The steps for modeling the method are described below:

**Step 1.** Define the decision matrix by including the weight of the criterion as following.

$$\begin{array}{c} \begin{array}{cccccc} Q_1 & Q_2 & \dots & Q_j & \dots & Q_n \\ w_1 & w_2 & \dots & w_j & \dots & w_n \\ A_1 & \begin{bmatrix} x_{11} & x_{12} & \dots & x_{1j} & \dots & x_{1n} \\ x_{21} & x_{22} & \dots & x_{2j} & \dots & x_{2n} \\ \vdots & \vdots & \ddots & \vdots & \ddots & \vdots \\ x_{i1} & x_{i2} & \dots & x_{ij} & \dots & x_{in} \\ \vdots & \vdots & \ddots & \vdots & \ddots & \vdots \\ x_{m1} & x_{m2} & \dots & x_{mj} & \dots & x_{mn} \end{bmatrix} \end{array} \end{array}$$

**Step 2.** Transformation of the evaluations into a utility scale with values between 0 and 100.

$$u_{ij} = \frac{100 \cdot (x_{ij} - M_j)}{R_j} \quad (6)$$

Where  $M_j = \min x_{ij}$ , for  $i = 1, \dots, m$  and  $R_j = \max x_{ij} - \min x_{ij}$ , for  $i = 1, \dots, m$

**Step 3.** Calculation of the weights  $w'_j$ .

$$w'_j = \frac{w_j \cdot R_j}{\sum_{j=1}^n w_j \cdot R_j} \quad (7)$$

**Step 4.** Calculation of the utility of each alternative according to Eq. (8).

$$\begin{array}{c} \begin{array}{cccccc} C_1 & C_2 & \dots & C_j & \dots & C_n \\ A_1 & \begin{bmatrix} u_{11} & u_{12} & \dots & u_{1j} & \dots & u_{1n} \\ u_{21} & u_{22} & \dots & u_{2j} & \dots & u_{2n} \\ \vdots & \vdots & \ddots & \vdots & \ddots & \vdots \\ u_{i1} & u_{i2} & \dots & u_{ij} & \dots & u_{in} \\ \vdots & \vdots & \ddots & \vdots & \ddots & \vdots \\ u_{m1} & u_{m2} & \dots & u_{mj} & \dots & u_{mn} \end{bmatrix} \end{array} \times \begin{array}{c} \begin{bmatrix} w'_1 \\ w'_2 \\ \vdots \\ w'_j \\ \vdots \\ w'_n \end{bmatrix} = \begin{bmatrix} u_{A1} \\ u_{A2} \\ \vdots \\ u_{Aj} \\ \vdots \\ u_{Am} \end{bmatrix} \end{array} \end{array} \quad (8)$$

## 2.5 | Neutrosophic ARAS

The neutrosophic ARAS method constitutes a multi-criteria method to determine the weights of external factors. To model the method, the steps proposed by the methodology in reference are taken into account [10, 11].

## 3 | Results

### 3.1 | Factors that Influence Strategic Decision-Making

Firstly, it is necessary to define which factors influence strategic decision-making in business management. To do this, the challenges or factors within and outside the entity must be analyzed (see Figure 1).

- Internal Factors (IF): Values, culture [12], organizational structure, financial situation, and human and technical resources of the company directly influence the decision-making process [13].
- External Factors (EF): Economic, political, social, technological, and environmental elements, as well as the competitive environment and market demands, are crucial when evaluating and determining business strategies.

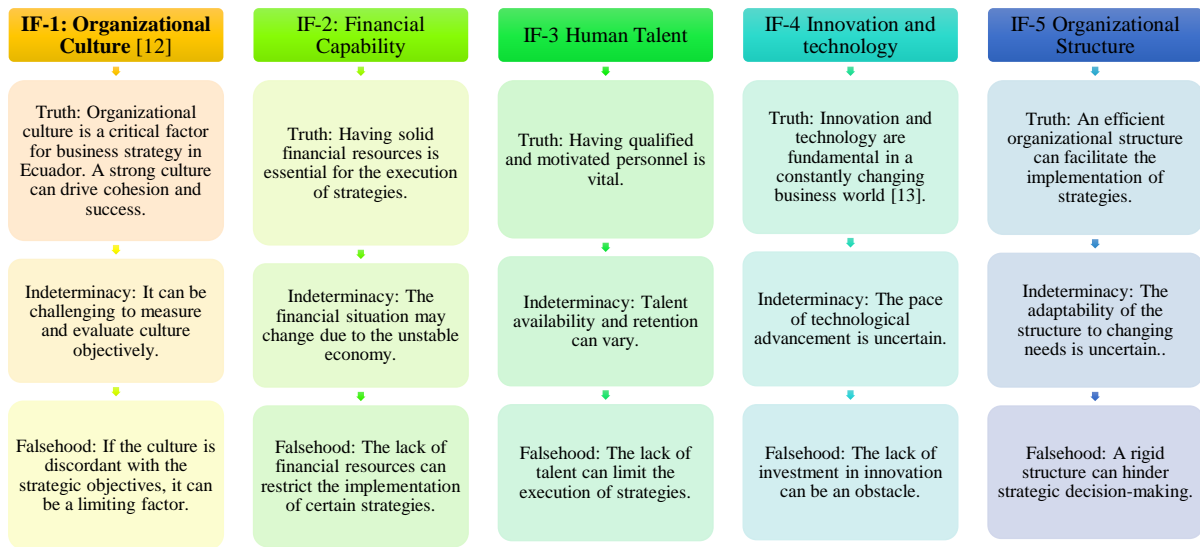


Figure 1. Identification of key internal factors. Source: own elaboration.

The PESTEL method is used to explore the political, economic, social, technological, environmental, and legal aspects influencing the neutrosophic analysis of external factors impacting strategic decision-making in business management in Ecuador:

#### 1. Politician (EF-1)

- Political stability: Level of government stability and its impact on economic and trade policies.
- Government change: Risk related to changes in political leadership and its impact on business policies.
- Regulation: Government regulations that directly affect business operations.
- Corruption: Impact of corruption on market stability and strategic decision making.

Neutrosophic component:

- Truth: Government decisions can influence the economy and the business market.
- Indeterminacy: Policies can change, generating uncertainty in decision-making.
- Falsehood: Political corruption can create barriers and distort the business environment.

#### 2. Economical (EF-2)

- Economic growth: Overall economic performance and its impact on business investment and spending.
- Inflation: Impact of inflation on purchasing power and operating costs.
- Exchange rate: Influence of the exchange rate on the competitiveness and profit margins of companies.
- COVID-19 pandemic: Effects of the pandemic on the local economy and its consequences for businesses.

Neutrosophic component:

- Truth: The country's economy directly affects companies.
- Indeterminacy: Economic and political fluctuations can generate instability.
- Falsehood: Lack of stability can threaten the growth and viability of companies.

## 3. Social (EF-3)

- Globalization: Level of influence and adaptation to global trends and practices.
- Consumer trends: Changes in consumer behavior and their impact on the demand for products and services.
- Education: Educational level of the population and its relationship with the talent available for companies.
- Cultural diversity: Impact of cultural diversity on business practices and the acceptance of products or services.

Neutrosophic component:

- Truth: Changes in demographics and culture affect consumer preferences.
- Indeterminacy: Social trends can be unpredictable.
- Falsehood: Social or cultural conflicts can negatively affect companies.

## 4. Technological (EF-4)

- Technological adoption: Degree of integration of new technologies and their impact on efficiency and competitiveness.
- Infrastructure: State of infrastructure and its influence on distribution and production.
- Investment in R&D: Degree of investment in research and development that drives innovation and improvement of products or services.

Neutrosophic component:

- Truth: Technology adoption can boost efficiency and competitiveness.
- Indeterminacy: Rapid technological evolution can be difficult to follow.
- Falsehood: Lack of technological investment can put companies at a disadvantage.

## 5. Ecological (EF-5)

- Environmental policy: Compliance with environmental regulations and their impact on sustainable business practices [14].
- Public awareness: Level of public awareness and concern for sustainability and the environment.
- Sustainability: Sustainable practices and their influence on the image and viability of companies.

Neutrosophic component:

- Truth: Environmental sustainability is increasingly relevant in decision-making.
- Indeterminacy: Environmental awareness can vary and evolve.
- Falsehood: The lack of environmental consideration can generate rejection in the market.

## 6. Legal (EF-6)

- Regulatory framework: Compliance and adaptation to local, regional, and national laws and regulations.
- Consumer protection: Regulations that protect consumers and affect business strategies.
- Labor laws: Labor legislation and its influence on human resources policies and practices.

Neutrosophic component:

- Truth: Legal regulations influence the operation of companies.
- Indeterminacy: Legal or compliance changes can be difficult to anticipate.
- Falsehood: Legal problems can represent a significant risk.

Detailing it in this way helps to understand the key external factors and their impact on strategic decision-making in the Ecuadorian business environment. Each dimension provides relevant information for business strategies by allowing a more comprehensive assessment of the influencing factors through the evaluation of criteria.

To obtain the neutrosophic importance weights of the criteria (see Figure 2), the modeling of the Neutrosophic Entropy method is carried out (see Table 3 to 5). The criteria constitute key parameters for measuring the effectiveness of the strategic decisions made [15, 16].

<p><b>Profitability</b></p> <ul style="list-style-type: none"> <li>Profitability refers to the ability of strategic decisions to generate financial benefits. It assesses the performance of investments made and the profits generated in relation to the costs incurred.</li> </ul>	<p><b>Sustainable Growth</b></p> <ul style="list-style-type: none"> <li>This criterion assesses whether strategic decisions lead to continuous and sustainable growth for the company. It focuses on long-term growth and aims to ensure that no compromises are made that could be detrimental to the future.</li> </ul>	<p><b>Financial Risk</b></p> <ul style="list-style-type: none"> <li>It measures the exposure to financial risk resulting from the strategic decisions made. It involves assessing the financial strength of the company, its ability to take risks, and manage potential challenges.</li> </ul>	<p><b>Responsibility towards Shareholders</b></p> <ul style="list-style-type: none"> <li>It focuses on how strategic decisions impact the relationship and commitment to shareholders by considering transparency, business ethics, and safeguarding their interests.</li> </ul>	<p><b>Innovation</b></p> <ul style="list-style-type: none"> <li>It assesses the extent to which strategic decisions drive innovation, both in products or services and internal processes. It considers the company's ability to adapt to market changes and trends, as well as its creativity in providing unique solutions.</li> </ul>
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**Figure 2.** Criteria to evaluate the factors. (Source: own elaboration).

These criteria are essential to determining the effectiveness of strategic decisions since they provide a holistic view of the impact of those decisions in different critical areas of business management.

**Table 3.** Neutrosophic entropy evaluation matrix.

Alternatives	Profitability	Sustainable growth	Innovation	Responsibility towards shareholders	Financial risk
	SVNN	SVNN	SVNN	SVNN	SVNN
EF-1	(0.54,0.51,0.52)	(0.44,0.61,0.62)	(0.24,0.81,0.82)	(0.34,0.71,0.72)	(0.54,0.51,0.52)
EF-2	(0.34,0.71,0.72)	(0.34,0.71,0.72)	(0.44,0.61,0.62)	(0,0.95,1)	(0.54,0.51,0.52)
EF-3	(0.64,0.41,0.42)	(0.74,0.31,0.32)	(0.34,0.71,0.72)	(0.84,0.21,0.22)	(0.54,0.51,0.52)
EF-4	(0.44,0.61,0.62)	(0.64,0.41,0.42)	(0.54,0.51,0.52)	(0.24,0.81,0.82)	(0.24,0.81,0.82)
EF-5	(0.64,0.41,0.42)	(0,0.95,1)	(0.24,0.81,0.82)	(0.44,0.61,0.62)	(0.64,0.41,0.42)

**Table 4.** Normalized decision matrix  $P_{ij}$ .

Alternatives	Profitability	Sustainable growth	Innovation	Responsibility towards shareholders	Financial risk
EF-1	(0,0.95,1)	(0,0.95,1)	(0,0.95,1)	(0,0.95,1)	(0,0.95,1)
EF-2	(0,0.95,1)	(0,0.95,1)	(0,0.95,1)	(0,0.95,1)	(0,0.95,1)
EF-3	(0,0.95,1)	(0.24,0.81,0.82)	(0,0.95,1)	(0.34,0.71,0.72)	(0,0.95,1)
EF-4	(0,0.95,1)	(0.24,0.81,0.82)	(0.24,0.81,0.82)	(0,0.95,1)	(0,0.95,1)
EF-5	(0,0.95,1)	(0,0.95,1)	(0,0.95,1)	(0,0.95,1)	(0.24,0.81,0.82)

**Table 5.** Calculation of  $E_j$ ,  $D_j$ , and  $W_j$  according to the entropy method.

Criteria	$E_j$	$D_j$	$W_j$	Order
C1	0.986	0.014	(0.11,0.90,0.94)	5
C2	0.938	0.062	(0.51,0.55,0.51)	2
C3	0.977	0.023	(0.11,0.90,0.94)	4
C4	0.892	0.108	(0.91,0.15,0.11)	1
C5	0.969	0.031	(0.11,0.90,0.94)	3

The neutrosophic entropy multicriteria analysis has provided weights for different evaluation criteria. By defining the criteria of responsibility towards shareholders and sustainable growth as having the highest neutrosophic weight.



### 3.2 | Evaluation of Internal Factors (Neutrosophic SMART Method)

Firstly, it is necessary to define which factors influence strategic decision-making in business management. To do this, the challenges or factors within and outside the entity must be analyzed (see Figure 1).

To evaluate and rank the importance weight of internal factors, the SMART Neutrosophic method is modeled (see Tables 6 and 7).

**Table 6.** Decision matrix.

Alternatives	Profitability	Sustainable growth	Innovation	Responsibility towards shareholders	Financial risk
	SVNN	SVNN	SVNN	SVNN	SVNN
$w_j$	(0.11,0.90,0.94)	(0.51,0.55,0.51)	(0.11,0.90,0.94)	(0.91,0.15,0.11)	(0.11,0.90,0.94)
<b>IF-1</b>	(0.64,0.41,0.42)	(0,0.95,1)	(0.74,0.31,0.32)	(0.64,0.41,0.42)	(0.54,0.51,0.52)
<b>IF-2</b>	(0.64,0.41,0.42)	(0.34,0.71,0.72)	(0.84,0.21,0.22)	(0.94,0.11,0.12)	(0.64,0.41,0.42)
<b>IF-3</b>	(0.74,0.31,0.32)	(0,0.95,1)	(0.24,0.81,0.82)	(0.24,0.81,0.82)	(0.94,0.11,0.12)
<b>IF-4</b>	(0.54,0.51,0.52)	(0.44,0.61,0.62)	(0.84,0.21,0.22)	(0.54,0.51,0.52)	(0.64,0.41,0.42)
<b>IF-5</b>	(0.54,0.51,0.52)	(0,0.95,1)	(0.64,0.41,0.42)	(0,0.95,1)	(0,0.95,1)
$M_j$	(0.54,0.51,0.52)	(0,0.95,1)	(0.24,0.81,0.82)	(0,0.95,1)	(0,0.95,1)
<b>Max</b>	(0.74,0.31,0.32)	(0.44,0.61,0.62)	(0.84,0.21,0.22)	(0.94,0.11,0.12)	(0.94,0.11,0.12)
$R_j$	(0,0.95,1)	(0.44,0.61,0.62)	(0.54,0.51,0.52)	(0.64,0.41,0.42)	(0.74,0.31,0.32)

**Table 7.** Utility Matrix.

Alternatives	Profitability	Sustainable growth	Innovation	Responsibility towards shareholders	Financial risk
	SVNN	SVNN	SVNN	SVNN	SVNN
$w_j$	(0.11,0.90,0.94)	(0.31,0.8,0.81)	(0.11,0.90,0.94)	(0.91,0.15,0.11)	(0.31,0.8,0.81)
$M_j$	(0.54,0.51,0.52)	(0,0.95,1)	(0.24,0.81,0.82)	(0,0.95,1)	(0,0.95,1)
$R_j$	(0,0.95,1)	(0.44,0.61,0.62)	(0.54,0.51,0.52)	(0.64,0.41,0.42)	(0.74,0.31,0.32)
<b>IF-1</b>	(0.34,0.71,0.72)	(0,0.95,1)	(0.74,0.31,0.32)	(0.54,0.51,0.52)	(0.44,0.61,0.62)
<b>IF-2</b>	(0.64,0.41,0.42)	(0.74,0.31,0.32)	(1,0,0)	(1,0,0)	(0.54,0.51,0.52)
<b>IF-3</b>	(1,0,0)	(0.34,0.71,0.72)	(0,0.95,1)	(0,0.95,1)	(1,0,0)
<b>IF-4</b>	(0,0.95,1)	(1,0,0)	(0.94,0.11,0.12)	(0.44,0.61,0.62)	(0.64,0.41,0.42)
<b>IF-5</b>	(0,0.95,1)	(0,0.95,1)	(0.54,0.51,0.52)	(0,0.95,1)	(0,0.95,1)

To evaluate and rank the importance weight of internal factors, the SMART Neutrosophic method is modeled (see Tables 6 and 7).

The application of the SMART Neutrosophic method allows defining the internal factors with the highest neutrosophic importance weight as:

- Financial capacity with a weight of (0.84, 0.21, 0.22), and
- Innovation and technology (0.54, 0.51, 0.52).

### 3.3 | Evaluation of Internal Risks (Neutrosophic ARAS Method)

To evaluate and rank the importance weight of external factors, the Neutrosophic ARAS method is modeled (see Tables 8 to 10).



**Table 8.** Decision matrix.

Alternatives	Profitability	Sustainable growth	Innovation	Responsibility towards shareholders	Risk financial
	SVNN	SVNN	SVNN	SVNN	SVNN
EF-1	(0.64,0.41,0.42)	(0.34,0.71,0.72)	(0.24,0.81,0.82)	(0.44,0.61,0.62)	(0.54,0.51,0.52)
EF-2	(0.34,0.71,0.72)	(0.54,0.51,0.52)	(0.64,0.41,0.42)	(0.64,0.41,0.42)	(0.44,0.61,0.62)
EF-3	(0.54,0.51,0.52)	(0.74,0.31,0.32)	(0.24,0.81,0.82)	(0.44,0.61,0.62)	(0.34,0.71,0.72)
EF-4	(0.34,0.71,0.72)	(0.34,0.71,0.72)	(0.44,0.61,0.62)	(0.24,0.81,0.82)	(0.34,0.71,0.72)
EF-5	(0.44,0.61,0.62)	(0.74,0.31,0.32)	(0,0.95,1)	(0.34,0.71,0.72)	(0.74,0.31,0.32)

**Table 9.** Normalized decision matrix.

Alternatives	Profitability	Sustainable growth	Innovation	Responsibility towards of shareholders	Risk financial
EF-1	(0.24,0.81,0.82)	(0,0.95,1)	(1,0,0)	(0,0.95,1)	(0,0.95,1)
EF-2	(0,0.95,1)	(0,0.95,1)	(1,0,0)	(0.24,0.81,0.82)	(0,0.95,1)
EF-3	(0,0.95,1)	(0.24,0.81,0.82)	(1,0,0)	(0,0.95,1)	(0,0.95,1)
EF-4	(0,0.95,1)	(0,0.95,1)	(1,0,0)	(0,0.95,1)	(0,0.95,1)
EF-5	(0,0.95,1)	(0.24,0.81,0.82)	(1,0,0)	(0,0.95,1)	(0.24,0.81,0.82)
Classification	B	B	NB	B	B
$w_j$	(0.11,0.90,0.94)	(0.31,0.8,0.81)	(0.11,0.90,0.94)	(0.91,0.15,0.11)	(0.31,0.8,0.81)

**Table 10.** Optimization function  $S_i$  based on weight  $W_j$  assignment.

Alternatives / Weight	Profitability	Growth sustainable	Innovation	Responsibility towards shareholders	Risk financial	$S_i$	$K_i$	$S_0 = 0.2166$
EF-1	0.0163	0.0372	0.0000	0.0989	0.0287	0.1811	83.59%	
EF-2	0.0092	0.0527	0.0000	0.1300	0.0247	0.2166	100.00%	
EF-3	0.0133	0.0700	0.0000	0.0873	0.0178	0.1884	86.98%	
EF-4	0.0089	0.0311	0.0000	0.0621	0.0217	0.1239	57.20%	
EF-5	0.0103	0.0700	0.0000	0.0757	0.0371	0.1931	89.13%	

The results of the Neutrosophic ARAS method evaluate the economic and legal dimensions as the external factors with the highest neutrosophic impact. Therefore, comprehensive solutions can be proposed to mitigate the impact of these factors.

### 3.4 | Solutions to Mitigate the Factors

Once the factors with the highest weight in strategic decision-making have been evaluated, possible solutions are identified. To achieve this, the integration of solutions for both internal and external factors is proposed, including indeterminacy as part of the results. The following are expressed:

- Ensure that the economic growth of the company complies with labor standards by generating employment and promoting sustainable growth.
- Constantly update systems to stay at the forefront.
- Implement automation systems to improve efficiency and accuracy.
- Explore and expand the local market with products adapted to the national economy.

- Foster collaboration with local research institutions, promoting political stability to ensure project continuity.

## 4 | Conclusion

Strategic management in Ecuador faces a variety of challenges in an environment characterized by political instability, economic variability, changing social trends, and growing environmental awareness. Evaluating strategic decision-making is crucial in this context, with neutrosophy providing a framework for assessing indeterminacies and multiple perspectives in business decision-making.

The assessment of the influence of internal and external factors on strategic decision-making highlights the existence of indeterminacies. What may be decisive in one context may not be so in another, emphasizing the need for a detailed and adaptive analysis of the current environment. The models of the proposed methods define financial capacity and integration into innovation and technology as internal factors. However, for external factors, work should be done on the economic and legal dimensions, as they constitute a key point in the strategic decision-making of companies.

The complexity of strategic decision-making underscores the need for adaptability and flexibility in business management. Considering multiple indeterminacies allows for more adaptable and resilient strategies to adapt to the changing dynamics of the Ecuadorian business environment. This approach can help companies better understand the indeterminacy and diversity of factors influencing strategic decision-making in business management in Ecuador.

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## Author Contribution

All authors contributed equally to this work.

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## Data Availability

The datasets generated during and/or analyzed during the current study are not publicly available due to the privacy-preserving nature of the data but are available from the corresponding author upon reasonable request.

## Conflicts of Interest

The authors declare that there is no conflict of interest in the research.

## Ethical Approval

This article does not contain any studies with human participants or animals performed by any of the authors.

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