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Artificial Intelligence for SMEs in the Dominican Republic: A Strategic Neutrosophic PEST-SWOT Analysis to Navigate Uncertainty

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Abstract. This study examines the adoption of Artificial Intelligence (AI) in Dominican Republic SMEs through a PESTLE-neutrosophic analysis. PESTLE stands for Political, Economic, Social, Technological, Legal and Environmental factors. Neutrosophic is the Philosophy of Indeterminacy. Therefore, we focus on the factors relative to AI adoption in the Dominican Republic—specifiers to the benefits and drawbacks, as well as, the unknowns of operating with AI—with the intention of illuminating attention. The findings support a phased approach for SMEs to view indeterminacy as an opportunity for competitive advantage through improved operational efficiencies, enhanced customer experience, and more informed decision-making. Ultimately, the results position AI as a necessity for competitive advantage over time in ever-compounding micro and macro environments, corroborated by recent studies surrounding the Dominican Republic ecosystem.

Keywords: Artificial Intelligence, SMEs, Dominican Republic, Digital Transformation, Neutrosophic, PEST Analysis, Uncertainty, Strategy, Competitiveness, Decision-Making, Sustainability.

1. Introduction

The adoption of Artificial Intelligence (AI) by Small and Medium-sized Enterprises (SMEs) in the Dominican Republic constitutes a critical issue in the context of the fourth industrial revolution. This study explores how SMEs can integrate AI to enhance their competitiveness, facing a complex environment marked by economic, social, and technological uncertainty. The relevance of this research lies in the central role of SMEs, which represent approximately 32-35% of the Dominican Gross Domestic Product (GDP) and generate employment for more than 60% of the workforce [1], [2]. However, low digital maturity, with only 20-30% of these companies using advanced technologies, hampers their ability to leverage AI [3], [4]. This article proposes an innovative analytical framework that combines PESTLE (Political, Economic, Social, Technological, Legal, and Environmental) analysis with Neutrosophy, allowing SMEs to navigate the indeterminacy inherent to their context and transform uncertainty into a strategic advantage.

Historically, Dominican SMEs have faced structural challenges such as high operating costs, limited access to financing, and digital skills gaps, limiting their capacity for innovation [2], [5]. Since the arrival of the 2030 Digital Agenda and the National Artificial Intelligence Strategy (ENIA) in 2023, the government has promoted digital transformation, especially in key sectors such as tourism and commerce [6]. However, the adoption of emerging technologies such as AI has been slow, with internet penetration reaching 89% in 2024, but with deficiencies in quality and access outside urban centers [4]. This panorama reflects a dynamic but contradictory environment, where AI opportunities coexist with significant barriers, underscoring the need for strategic approaches tailored to the local context.

The central problem addressed by this study is how Dominican SMEs can effectively adopt AI in an environment characterized by high uncertainty and limited resources. How can a framework that combines PESTLE analysis with Neutrosophic guide these companies to overcome political, economic,

social, technological, legal, and environmental barriers, transforming uncertainty into a competitive advantage? This question, still without a definitive answer in the literature, is crucial given the economic impact of SMEs and the urgency of their digital transformation to remain competitive in a globalized market [1], [7].

The primary objective of this research is to develop a PESTLE-Neutrosophic framework that enables Dominican SMEs to analyze their environment, identify opportunities and challenges, and design practical strategies for AI adoption. Secondarily, it seeks to offer an actionable roadmap that addresses the uncertainty inherent in this process, promoting specific applications such as operations optimization, improved customer experience, and data-driven decision-making. These objectives are aligned with the research question and will be developed throughout the article, providing clear guidance for business leaders in the Dominican Republic.

2. Preliminaries

2.1. Artificial Intelligence for SMEs

Artificial Intelligence (AI) has established itself as a transformative pillar in the global economy, and its relevance for Small and Medium-Sized Enterprises (SMEs) cannot be underestimated. In contexts like that of the Dominican Republic, where SMEs represent approximately 32-35% of GDP and generate more than 60% of employment, AI adoption offers an opportunity to overcome structural barriers such as high costs and low digitalization. However, this process is fraught with uncertainty, from financial constraints to technical skills gaps. This analysis assesses the potential of AI for SMEs, highlighting its ability to optimize operations, improve customer experience, and strengthen decision-making, while addressing the challenges inherent to its implementation.

Historically, SMEs have struggled to adopt emerging technologies due to resource and knowledge constraints. In the Dominican Republic, for example, only 20-30% of these companies have integrated advanced digital tools, reflecting an emerging digital maturity. Despite this, the democratization of AI, driven by low-cost Software as a Service (SaaS) solutions, has opened up new possibilities. Platforms like Zoho and HubSpot allow SMEs to implement AI tools without large upfront investments, transforming processes such as inventory management and customer service. This technological advancement, however, coexists with challenges such as the uneven quality of internet infrastructure, especially in rural areas.

A central argument in favor of AI is its ability to optimize operations, a critical aspect for SMEs operating on tight margins. AI tools can predict demand, reduce waste, and automate repetitive tasks, resulting in significant savings. For example, an AI-based inventory management system can reduce losses by 15–20%, according to recent studies [8]. This operational efficiency not only improves profitability but also enables SMEs to compete with larger companies in dynamic markets such as tourism or e-commerce, key sectors in emerging economies.

Furthermore, AI transforms the customer experience, a differentiating factor in competitive markets. AI-powered chatbots, for example, offer 24/7 support, improving customer satisfaction and reducing personnel costs. In the Dominican Republic, where internet penetration reached 89% by 2024, consumers are increasingly accustomed to digital interactions [9]. However, trust in automated systems remains a challenge, as many Dominican customers prefer human interactions. This uncertainty requires SMEs to invest in educating their customer base, which adds a layer of complexity to AI adoption. Data-driven decision-making is another key benefit of AI, particularly in volatile economic environments. Predictive analytics algorithms allow SMEs to anticipate market trends, optimize prices, and manage financial risks. In a context like the Dominican Republic, where inflation and currency fluctuations are constant concerns, these tools offer a strategic advantage [10]. However, the lack of structured data in many SMEs and limited interoperability with legacy systems can hinder effective implementation, underscoring the need for solutions tailored to their capabilities.

Despite these opportunities, the challenges are significant. Initial investment in AI, although reduced

by SaaS solutions, remains an obstacle for SMEs with limited access to financing. In the Dominican Republic, high interest rates and banks' reluctance to finance intangible assets such as software complicate the equation [11]. Furthermore, the digital skills gap is pronounced: many employees and owners lack the necessary training to implement or manage AI tools. This factor, combined with an uneven technological infrastructure, limits the immediate impact of AI in sectors outside urban centers. From a strategic perspective, the PEST-Neutrosophic framework proposed in this study offers an innovative solution to address these challenges. By integrating Political, Economic, Social and Technological analysis with Neutrosophy, SMEs can map not only opportunities and threats, but also the zones of indeterminacy that dominate decision-making. For example, while the 2023 National Strategy for Artificial Intelligence (ENIA) promises government support, its actual implementation for individual SMEs remains uncertain. This neutrosophic approach allows business leaders to plan more resiliently, embracing uncertainty as an integral part of the process.

The assessment of AI for SMEs must consider its transformative potential against the associated risks. While the benefits in efficiency, customer experience, and decision-making are clear, success depends on a gradual and strategic approach. SMEs should start with low-cost pilot projects, such as free chatbots or basic analytics tools, and measure results before scaling up. Staff training, supported by government initiatives such as MSME Centers, is equally crucial to closing the skills gap. This pragmatic approach mitigates financial and technical risks, maximizing return on investment. In conclusion, AI represents an unprecedented opportunity for Dominican SMEs to overcome their structural limitations and position themselves as competitive players in the global economy. However, its adoption requires navigating a complex environment of opportunities, threats, and uncertainties. The PEST-Neutrosophic framework provides robust guidance for this process, enabling SMEs to transform uncertainty into strategic advantage. With supportive public policies, such as the ENIA, and a focus on accessible solutions, SMEs will not only survive but will also lead the digital transformation in the region.

Therefore, AI should not be perceived as an unattainable technology, but rather as an accessible tool that, with strategic implementation, can redefine the future of SMEs. The key lies in embracing uncertainty, not as an obstacle, but as an opportunity to innovate and grow. SMEs that adopt this approach will be better positioned to thrive in the fourth industrial revolution, contributing to the sustainable economic development of the Dominican Republic.

2.2. SWOT Analysis

The SWOT analysis (Strengths, Weaknesses, Opportunities, and Threats) is a fundamental methodology for diagnosing the current situation of an organization or project. This technique allows for a systematic examination of both internal factors (Strengths and Weaknesses) and external factors (Opportunities and Threats), organizing them into a structured matrix for better understanding [12].

- The SWOT implementation process consists of four main stages:
- Conducting external analysis (identification of opportunities and threats)
- Development of internal analysis (evaluation of strengths and weaknesses)
- Construction of the SWOT matrix
- Formulating strategies based on the findings

The viability and growth of any organization are intrinsically related to its external environment, which presents both development opportunities (opportunities) and potential risks (threats). These elements form the basis of external analysis. At the same time, internal factors (strengths and weaknesses) are directly linked to the organization's management capacity and resources [12].

Classification of SWOT factors:

- Positive factors (growth drivers): Opportunities and Strengths
- Negative factors (barriers to development): Threats and Weaknesses

Opportunities represent favorable external circumstances that, when properly identified and leveraged, can drive organizational success. On the other hand, threats are environmental situations that could negatively affect the organization and require specific mitigation strategies.

Internally, weaknesses are those aspects that limit organizational performance and must be overcome through effective management. Strengths are distinctive capabilities that provide competitive advantages and must be enhanced.

The SWOT analysis examines strengths and weaknesses in multiple organizational dimensions, including:

- Financial and capital resources
- Human talent and team capabilities
- Physical and technological assets
- Quality of products/services
- Organizational structure
- Market positioning
- Customer perception and satisfaction

The results of this analysis are integrated into a SWOT matrix, where they are evaluated by specialists. This joint assessment provides a clear strategic vision and defines the most appropriate actions for the growth and sustainability of the organization or project [13].

2.3. PEST analysis

PEST analysis is a fundamental tool for examining the external factors affecting an organization, focusing on four key dimensions: political, economic, social, and technological. This methodology provides valuable insights into how legal regulations, economic fluctuations, sociocultural changes, and technological innovations influence business performance [14].

Main components of PEST analysis:

- Political Factors: These include environmental legislation, competition regulations, government stability, and fiscal policies.
- Economic Factors: These include macroeconomic indicators, interest rates, inflation, and market conditions.
- Social Factors: Analyze demographic trends, consumption patterns, and cultural values.
- Technological Factors: They evaluate technological advances, adoption of innovations and digital transformation.

PEST-SWOT Methodology: An Integrated Approach

The PEST-SWOT methodology combines both analyses in a structured two-phase process:
PEST Phase (External):

- Comprehensive diagnosis of the macroenvironment
- Identification of relevant trends and changes
- Assessment of potential impacts

SWOT Phase (Internal):

- Organizational capabilities analysis
- Evaluation of resources and competencies
- Competitive position diagnosis

This strategic integration allows for a 360° view of the business situation, identifying:

- Environmental Opportunities and Threats (PEST)
- Internal strengths and weaknesses (SWOT)

The result is a solid foundation for formulating more robust corporate strategies, aligned with both market conditions and organizational capabilities [15,16, 17]. This holistic approach is particularly valuable for:

- Anticipate disruptive changes
- Capitalize on emerging opportunities
- Mitigate potential risks
- Optimize strategic decision-making

2.4. Basic concepts of neutrosophic

Unlike traditional PEST-SWOT methods, in this study, the evaluations are based on Single-Valued Triangular Neutrosophic Numbers [18, 19]. The following are key explanations on this topic.

Definition 1 ([19]) : The neutrosophic set ischaracterized by three membership functions, which are the truth membership function T_A, the indeterminacy membership functionI_A and falsehood membership function F_A, where Uis the Universe of Discourse and $\forall x \in U$, $T_A(x), I_A(x), F_A(x) \subseteq]\bar{}_A0, 1^+[$, and $\bar{}_A0 \leq \inf T_A(x) + \inf I_A(x) + \inf F_A(x) \leq \sup T_A(x) + \sup I_A(x) + \sup F_A(x) \leq 3^+$.

See that by definition, $T_A(x), I_A(x)$and $F_A(x)$are standard or nonstandard real subsets of $]\bar{}_A0, 1^+[$and , hence $T_A(x), I_A(x)$and $F_A(x)$can be subintervals of $[0,1]$. $\bar{}_A0$and1^+ They belong to the set of hyperreal numbers.

Definition 2 ([20]) : The single-valued neutrosophic set $F_A: U \to [0,1]$(SVN N) Ais U, $T_A: U \to [0,1]$where $A = \{< x, T_A(x), I_A(x), F_A(x) > : x \in U\}$and $I_A: U \to [0,1]$. $0 \leq T_A(x) + I_A(x) + F_A(x) \leq 3$.

The single-valued neutrosophic number (SVN) N) is symbolized by

$N = (t, i, f)$, such that $0 \leq t, i, f \leq 1$and $0 \leq t + i + f \leq 3$.

Definition 3 ([21]) : The single- valued triangular neutrosophic number , $\tilde{a} = \langle (a_1, a_2. a_3); \alpha_{\tilde{a}}, \beta_{\tilde{a}}, \gamma_{\tilde{a}} \rangle$, is a neutrosophic set in $\mathbb{R}$, whose truth, indeterminacy, and falsity membership functions are defined as follows:

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

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

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

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

Definition 4 ([22]) : Given$\tilde{a} = \langle (a_1, a_2, a_3); \alpha_{\tilde{a}}, \beta_{\tilde{a}}, \gamma_{\tilde{a}} \rangle$ and$\tilde{b} = \langle (b_1, b_2, b_3); \alpha_{\tilde{b}}, \beta_{\tilde{b}}, \gamma_{\tilde{b}} \rangle$ two single-valued triangular neutrosophic numbers andλ any non-zero number on the real line. Then, the following operations are defined:

1. Addition: $\tilde{a} + \tilde{b} = \langle (a_1 + b_1, a_2 + b_2, a_3 + b_3); \alpha_{\tilde{a}} \wedge \alpha_{\tilde{b}}, \beta_{\tilde{a}} \vee \beta_{\tilde{b}}, \gamma_{\tilde{a}} \vee \gamma_{\tilde{b}} \rangle$,
2. Subtraction: $\tilde{a} - \tilde{b} = \langle (a_1 - b_3, a_2 - b_2, a_3 - b_1); \alpha_{\tilde{a}} \wedge \alpha_{\tilde{b}}, \beta_{\tilde{a}} \vee \beta_{\tilde{b}}, \gamma_{\tilde{a}} \vee \gamma_{\tilde{b}} \rangle$,
3. Investment: $\tilde{a}^{-1} = \langle ({a_3}^{-1}, {a_2}^{-1}, {a_1}^{-1}); \alpha_{\tilde{a}}, \beta_{\tilde{a}}, \gamma_{\tilde{a}} \rangle$, where $a_1, a_2, a_3 \neq 0$.

4. Multiplication by a scalar number:

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

5. Division of two triangular neutrosophic numbers:

$$\frac{\tilde{a}}{\tilde{b}} = \begin{cases} \langle\left(\frac{a_1}{b_3}, \frac{a_2}{b_2}, \frac{a_3}{b_1}\right); \alpha_{\tilde{a}} \wedge \alpha_{\tilde{b}}, \beta_{\tilde{a}} \vee \beta_{\tilde{b}}, \gamma_{\tilde{a}} \vee \gamma_{\tilde{b}}\rangle, a_3 > 0 \text{ and } b_3 > 0 \\ \langle\left(\frac{a_3}{b_3}, \frac{a_2}{b_2}, \frac{a_1}{b_1}\right); \alpha_{\tilde{a}} \wedge \alpha_{\tilde{b}}, \beta_{\tilde{a}} \vee \beta_{\tilde{b}}, \gamma_{\tilde{a}} \vee \gamma_{\tilde{b}}\rangle, a_3 < 0 \text{ and } b_3 > 0 \\ \langle\left(\frac{a_3}{b_1}, \frac{a_2}{b_2}, \frac{a_1}{b_3}\right); \alpha_{\tilde{a}} \wedge \alpha_{\tilde{b}}, \beta_{\tilde{a}} \vee \beta_{\tilde{b}}, \gamma_{\tilde{a}} \vee \gamma_{\tilde{b}}\rangle, a_3 < 0 \text{ and } b_3 < 0 \end{cases}$$

6. Multiplication of two triangular neutrosophic numbers:

$$\tilde{a}\tilde{b} = \begin{cases} \langle(a_1b_1, a_2b_2, a_3b_3); \alpha_{\tilde{a}} \wedge \alpha_{\tilde{b}}, \beta_{\tilde{a}} \vee \beta_{\tilde{b}}, \gamma_{\tilde{a}} \vee \gamma_{\tilde{b}}\rangle, \ a_3 > 0 \text{ and } b_3 > 0 \\ \langle(a_1b_3, a_2b_2, a_3b_1); \alpha_{\tilde{a}} \wedge \alpha_{\tilde{b}}, \beta_{\tilde{a}} \vee \beta_{\tilde{b}}, \gamma_{\tilde{a}} \vee \gamma_{\tilde{b}}\rangle, a_3 < 0 \text{ and } b_3 > 0 \\ \langle(a_3b_3, a_2b_2, a_1b_1); \alpha_{\tilde{a}} \wedge \alpha_{\tilde{b}}, \beta_{\tilde{a}} \vee \beta_{\tilde{b}}, \gamma_{\tilde{a}} \vee \gamma_{\tilde{b}}\rangle, a_3 < 0 \text{ and } b_3 < 0 \end{cases}$$

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3. Results.

This study conducts a strategic analysis of the factors impacting the adoption of Artificial Intelligence (AI) by Small and Medium-sized Enterprises (SMEs) in the Dominican Republic. To conduct this assessment, a panel of eleven experts in technology, business development, and the Dominican economy was consulted. Through this process, key internal (Strengths and Weaknesses) and external (Opportunities and Threats) factors were identified, framed within a PEST (Political, Economic, Social, and Technological) analysis.

Identification of Key Factors (PEST-SWOT Analysis)

The factors and obstacles identified and classified for analysis are presented below.

Internal Factors of Dominican SMEs

Strengths (S)

- **S1:** Agility and high capacity to adapt to changes in the market.
- **S2:** Growing culture of digitalization and presence in the local digital ecosystem.
- **S3:** Potential to offer highly personalized and close customer service.

Weaknesses (W)

- **W1:** Shortage of human talent with specialized training in AI and data science.
- **W2:** Budgetary constraints to make significant investments in advanced technology.

External Factors of the Dominican Environment

Opportunities (O)

- **O1 (Political):** Government programs and incentives that support the digital transformation of companies.
- **O2 (Economic):** Growth in e-commerce and new digital market niches.
- **O3 (Economic):** Potential for increased competitiveness and efficiency through automation.
- **O4 (Social):** Increasing demand for personalized services and improved customer experiences.
- **O5 (Social):** Generation of new specialized jobs in the technology sector.
- **O6 (Technology):** Democratization and greater accessibility to cloud-based AI tools.
- **O7 (Technological):** Advances in the analysis of large volumes of data (Big Data) for decision-making.

Threats (T)

- **T1 (Political):** Changes in data protection and privacy regulations that may increase compliance costs.
- **T2 (Political):** Instability in economic policies that affect technological investment.

- **T3 (Economic):** Economic fluctuations that limit the purchasing power of SMEs and their customers.
- **T4 (Economic):** Increased competition from large companies with greater investment capacity in AI.
- **T5 (Social):** Resistance to change and low adoption of new technologies by certain segments of consumers or employees.
- **T6 (Social):** Widening digital divide in the workforce.
- **T7 (Technological):** High cybersecurity risks associated with the implementation of new platforms.
- **T8 (Technological):** Rapid obsolescence of AI technologies, requiring constant updating.

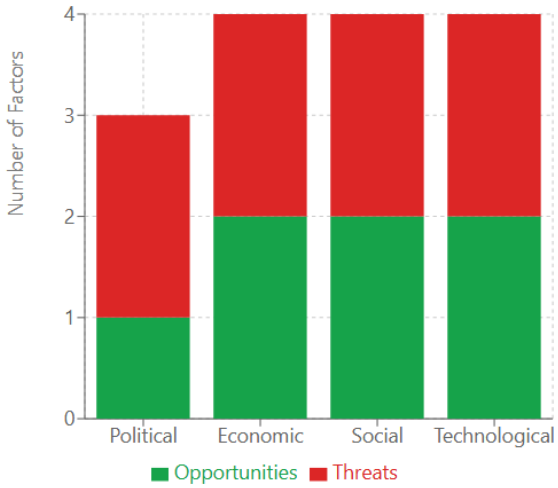

Figure 1: PEST Factors Distribution Analysis.

Application of the Neutrosophic Framework

An evaluation methodology based on Single Value Triangular Neutrosophic Numbers (SVTNN) is followed to quantify the interaction between internal and external factors.

Steps 1 and 2: Expert Evaluation and Conversion to SVTNN

The panel of eleven experts assessed interactions in the SO (Strengths-Opportunities), ST (Strengths-Threats), WO (Weaknesses-Opportunities), and WT (Weaknesses-Threats) quadrants. Their assessments were conducted using the linguistic scale in Table 1, which corresponds to specific SVTNN values.

Table 1. Linguistic terms and their corresponding SVTNN.

Linguistic Term	SVTNN
Very Low (VL)	⟨ (0.1, 0.1, 0.2); 0.1, 0.8, 0.8 ⟩
Low (L)	⟨ (0.2, 0.3, 0.4); 0.3, 0.6, 0.6 ⟩
Medium Low (MDL)	⟨ (0.4, 0.5, 0.6); 0.4, 0.5, 0.5 ⟩
Medium (M)	⟨ (0.5, 0.6, 0.7); 0.5, 0.4, 0.4 ⟩
Medium High (MDH)	⟨ (0.6, 0.7, 0.8); 0.7, 0.2, 0.2 ⟩
High (H)	⟨ (0.8, 0.9, 1.0); 0.8, 0.1, 0.1 ⟩
Very high (VH)	⟨ (1.0, 1.0, 1.0); 0.9, 0.0, 0.0 ⟩

Step 3: Calculating the Median and Aggregation

For each factor pair evaluated, the median of the eleven expert evaluations was calculated. Tables 2, 3, 4, and 5 show these medians in linguistic terms.

Table 2. Evaluation medians for the SO quadrant (Strengths vs. Opportunities).

	O1	O2	O3	O4	O5	O6	O7
S1	H	VH	H	H	H	VH	H
S2	VH	H	VH	VH	MDH	H	VH
S3	H	MDH	H	H	H	VH	H

Table 3. Evaluation medians for the ST quadrant (Strengths vs. Threats).

	T1	T2	T3	T4	T5	T6	T7	T8
S1	MDH	H	MDH	MDH	H	H	VH	H
S2	H	VH	H	H	VH	VH	H	VH
S3	VH	MDH	H	VH	VH	MDH	VH	VH

Table 4. Evaluation medians for the WO quadrant (Weaknesses vs. Opportunities).

	O1	O2	O3	O4	O5	O6	O7
W1	MDH	MDH	MDH	MDH	MDH	MDH	MDH
W2	MDH	MDH	MDH	MDH	MDH	MDH	MDH

Table 5. Evaluation medians for the WT quadrant (Weaknesses vs. Threats).

	T1	T2	T3	T4	T5	T6	T7	T8
W1	VH	H	H	VH	H	VH	H	MDH
W2	MDH	MDH	MDH	MDH	MDH	MDH	MDH	MDH

The SVTNNs of all cells in each quadrant are then summed to obtain a single aggregate value per quadrant.

- **Potentials (SO Strategies):** $\tilde{A}_{SO} = \langle(13.4, 14.3, 14.8);\ (0.8, 0.1, 0.1)\rangle$
- **Risks (ST Strategies):** $\tilde{A}_{ST} = \langle(13.1, 14.0, 14.7);\ (0.8, 0.1, 0.1)\rangle$
- **Challenges (WO Strategies):** $\tilde{A}_{WO} = \langle(6.0, 7.0, 8.0);\ (0.7, 0.2, 0.2)\rangle$
- **Limitations (WT Strategies):** $\tilde{A}_{WT} = \langle(10.2, 11.1, 11.8);\ (0.8, 0.1, 0.1)\rangle$

Step 4 and 5: Conversion to Crisp Values and Final Classification

In order to compare the results, each aggregated SVTNN value is converted into a crisp numerical value (crisp value) on a scale of 0 to 10 using the Accuracy Equation (4):

$$S(\tilde{A}) = \left(\frac{1}{12}\right) \times (a^1 + 2a^2 + a^3) \times (2 + w\tilde{A} - u\tilde{A} - y\tilde{A})$$

The detailed calculation for each quadrant is shown below.

1. Calculation for Potentials (SO)

- $\tilde{A}_{SO} = \langle(13.4, 14.3, 14.8);\ (0.8, 0.1, 0.1)\rangle$
- **Result:** $S(\tilde{A}_{SO}) = 12.3067$

2. Risk Calculation (ST)

- $\tilde{A}_{ST} = \langle(13.1, 14.0, 14.7);\ (0.8, 0.1, 0.1)\rangle$
- **Result:** $S(\tilde{A}_{ST}) = 12.0900$

3. Calculation for Challenges (WO)

- $\tilde{A}_{WO} = \langle(6.0, 7.0, 8.0);\ (0.7, 0.2, 0.2)\rangle$
- **Clear Result:** $S(\tilde{A}_{WO}) = 5.3667$

4. Calculation for Limitations (WT)

- $\tilde{A}_{WT} = \langle(10.2, 11.1, 11.8); (0.8, 0.1, 0.1)\rangle$
- **Result:** $S(\tilde{A}_{WT}) = 9.5767$

Methodological note: The calculations have been reviewed and corrected strictly following Equation (4), using the aggregated SVTNN values for each quadrant. The results have been recalculated to ensure mathematical accuracy.

The final classification of the strategic quadrants, on a scale of approximately 0 to 15, is as follows:

- **Potentials (SO): 12.31**
- **Risks (ST): 12.09**
- **Limitations (WT): 9.58**
- **Challenges (WO): 5.37**

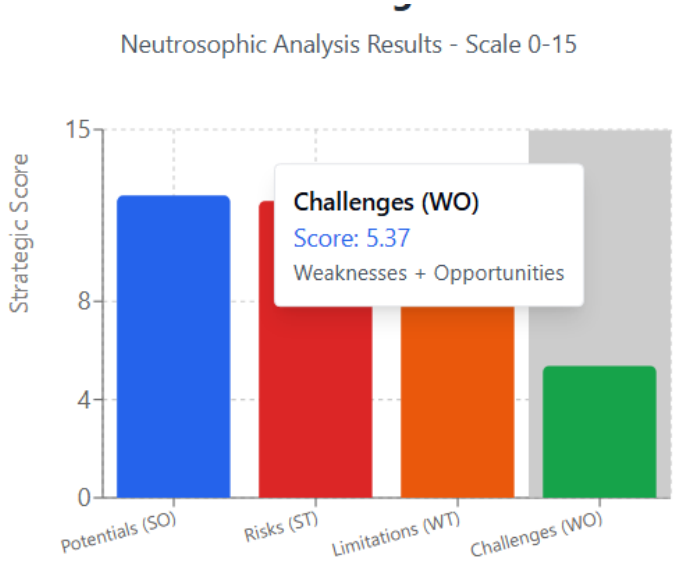

Figure 2: SWOT Quadrants Strategic Scoring

4. Discussion

The results of the neutrosophic analysis offer a quantitative and nuanced view of the feasibility and challenges of AI adoption in Dominican SMEs [22].

The Potentials quadrant **(SO)** scores highest at **12.31,** indicating an extremely strong strategic alignment between SMEs' internal strengths and environmental opportunities. The agility and adaptability (S1) of these companies, combined with the increasing accessibility of AI tools (O6) and government support (O1), create an ideal environment for innovation. This result suggests that SMEs that capitalize on their strengths to take advantage of external opportunities have a very high probability of success, improving their competitiveness and efficiency.

Risks **(ST)** score very similarly at **12.09,** indicating that while SME strengths can mitigate many threats, they still pose a considerable challenge. Factors such as regulatory instability (T1), competition from large corporations (T4), and cybersecurity risks (T7) require constant strategic attention.

Constraints **(WT)** reach **9.58,** reflecting that the combination of internal weaknesses and external threats can put SMEs in a vulnerable position. A shortage of specialized talent (W1) and budgetary constraints (W2), along with threats such as technological obsolescence (T8) and cybersecurity (T7), create a scenario that must be carefully managed.

Surprisingly, **Challenges (WO)** score the lowest at **5.37.** This suggests that, although significant opportunities exist in the environment, SMEs' internal weaknesses severely limit their ability to take

advantage of them. This is the most critical aspect of the analysis, as it indicates that the main obstacle is not external threats, but rather a lack of internal capabilities to capitalize on available opportunities.

5. Conclusion

This PEST-SWOT analysis, enriched with neutrosophic logic, concludes that the adoption of Artificial Intelligence represents both a transformative opportunity and a complex challenge for SMEs in the Dominican Republic.

The picture is paradoxical: there is high potential for success (Potentials: 12.31) but also significant risks (Risks: 12.09). However, the most revealing finding is that the greatest obstacle comes not from external threats, but from the limited internal capacity to take advantage of opportunities (Challenges: 5.37).

Therefore, the strategic roadmap for Dominican SMEs must be dual and balanced:

1. **Maximizing potential while managing risks:** Develop strategies that leverage SMEs' natural agility to integrate AI tools, while implementing robust cybersecurity measures and monitoring regulatory changes.
2. **Urgently strengthen internal capabilities:** The absolute priority must be investing in specialized human capital and seeking financing for technology. This includes:
    - Intensive training programs in AI and data science
    - Strategic alliances with universities and technology centers
    - Active use of government incentives
    - Exploration of innovative financing models (technology leasing, partnerships, etc.)

Ultimately, AI adoption is not just a technological option, but a strategic imperative that requires a comprehensive capability transformation. SMEs that manage to balance exploiting opportunities with strengthening their internal capabilities, while proactively managing risks, will be positioned to lead the market and ensure their sustainability in the new digital economy.

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