Special Issue: Neutrosophy in Artificial Intelligence: Advances and Applications from the Joint Conferences of BARNA Management School (Dominican Republic) and Universidad del Trabajo del Uruguay (August 6–8, 2025), Vol. 92, 2025

University of New Mexico

Validation of Relationships between Effective Leadership and Organizational Performance through Workplace Well-being: Formulation of Neutrosophic Plithogenic Hypotheses in the Context of Ecuadorian Public Higher Education

Otto Villaprado Chávez[1] and Jaime Rivera Camino[2]

[1]CENTRUM Católica Graduate Business School, Pontificia Universidad Católica del Perú, Lima, Peru. tto.villaprado@pucp.pe

[2]Associate Professor and Director, PhD Program, CENTRUM Católica Graduate Business School, Pontificia Universidad Católica del Perú, Lima, Peru. rjaime@pucp.pe

Abstract. This investigation correlates effective leadership with organizational performance of public universities in Ecuador, while employee well-being plays a mediating role. Such a topic is relevant because public educational management must be maximized since many public entities struggle with resources and human talent—such challenges translate to critical determinants of institutional quality and public and private market competitiveness. Moreover, whilst literature exists on leadership and performance, few have explored the mediation role of employee well-being in Latin America; thus, an opportunity arises to fill the literature gap with meaningful findings. Thus, to solve the problem, an approach based on neutrosophic plithogenic hypotheses occurred alongside structural equation modeling and researcher-validated questionnaires to assess 285 professors at four public universities. The findings indicate effective leadership positively influences organizational performance while employee well-being significantly mediates the relationship between the two variables; 54.3% of the organizational performance variance is attributed to employee well-being. Therefore, this work contributes to the field by finding empirical validation of a relational model between three variables while accounting for uncertainty via neutrosophics—all of which creates a unique deviation from effective leadership theory. In addition, it helps educational leaders practically by allowing the creation of policies based on teacher input for teacher well-being and subsequently, effective and higher-performing public universities.

Keywords: Effective Leadership, Workplace Well-being, Organizational Performance, Public Universities, Plithogenic Hypotheses, Neutrosophic Hypotheses, Higher Education.

1. Introduction

This research analyzes the relationship between effective leadership and organizational performance in Ecuadorian public universities, exploring the mediating role of employee well-being through an approach based on neutrosophic polytogenic hypotheses. This topic is important due to the need to optimize management in public educational institutions, where limited resources and challenges in human talent management directly impact educational quality and institutional competitiveness. Effective leadership is recognized as a key factor in driving superior organizational results, influencing not only productivity but also the work environment [1]. In educational contexts, leadership that fosters faculty motivation and commitment can transform institutional performance [2]. The relevance of this study

lies in its integrative approach, which combines leadership, well-being, and performance, offering a novel perspective to address challenges in public higher education. Furthermore, it responds to the growing demand for models that consider the complexity of organizational dynamics in environments with high uncertainty [3]. By integrating workplace well-being as a mediator, this research seeks to generate knowledge that supports the design of more effective educational policies, contributing to the sustainable development of public universities.

Over the past decades, the study of leadership has evolved significantly, moving from trait-centered approaches to more complex models that integrate influence and power into organizational dynamics [4]. In the educational field, research has highlighted that effective leadership is essential for improving institutional performance, especially in public universities facing budget constraints and increasing quality demands [5]. Since the 1990s, theories such as transformational leadership have emphasized the importance of inspiring collaborators to achieve common goals [6]. In Ecuador, the context of public universities has been marked by reforms aimed at strengthening management and academic performance, which has intensified interest in leadership as a driver of change [7]. However, few studies have explored how employee well-being mediates this relationship, especially in Latin American environments where working conditions are often complex. This work sits at the intersection of these dynamics, addressing a gap in the literature by incorporating approaches that manage uncertainty and ambiguity in organizational interactions.

The central problem of this research focuses on determining how effective leadership influences the organizational performance of Ecuadorian public universities, considering employee well-being as a mediating factor. Despite advances in the understanding of leadership, a gap persists in the integration of variables such as employee well-being in specific educational contexts in Latin America [8]. How does employee well-being mediate the relationship between effective leadership and organizational performance in Ecuadorian public universities? This question guides the study, which seeks to clarify the interactions between these constructs in an environment characterized by resource constraints and high organizational complexity. The magnitude of the problem lies in its direct impact on educational quality and the sustainability of public institutions. By addressing this question, the study aims to offer a deeper understanding of the mechanisms that enhance institutional performance, providing empirical evidence that can guide educational management in similar contexts.

The main objective of this research is to empirically validate the relational model that links effective leadership with organizational performance, mediated by occupational well-being, using neutrosophic hypotheses. Specifically, the following are sought: first, to evaluate the direct influence of effective leadership on organizational performance; second, to analyze the impact of leadership on faculty occupational well-being; and third, to determine the mediating role of occupational well-being in this relationship. These objectives align with the research question, ensuring a coherent approach that combines theory and practice. By using structural equation modeling and validated questionnaires, applied to a sample of 285 faculty members, the study aims to generate robust findings that contribute to knowledge in the field of educational leadership. By integrating a neutrosophic approach, the uncertainty inherent in human perceptions is addressed, enriching the analysis of organizational dynamics in the context of Ecuadorian public higher education.

2. Preliminary

2.1. Effective Leadership and Organizational Performance

Effective leadership is a crucial element for the success of organizations, particularly in complex environments such as public universities, where structural challenges and quality demands require exceptional management. This concept, understood as a leader's ability to inspire and guide employees toward common goals, has been widely recognized for its impact on organizational performance. In the

educational field, an effective leader not only drives academic results but also fosters a work environment that promotes faculty motivation and engagement. The relevance of this topic lies in its ability to transform institutions in resource-limited contexts, such as Ecuador, where public universities face budgetary constraints and pressures for quality standards. This analysis examines how effective leadership influences organizational performance, highlighting the mediating role of employee well-being. By addressing this dynamic, we seek to offer a comprehensive perspective that combines theory and practice. Evidence suggests that leaders who prioritize the well-being of their teams can achieve superior institutional results. Therefore, understanding this relationship is essential for designing strategies that strengthen educational management.

Over time, the study of leadership has transitioned from approaches focused on individual characteristics to more complex models, such as transformational leadership, which emphasizes the importance of influence and motivation. Since the 1980s, theories have emphasized how effective leaders can transform organizations by aligning individual efforts with strategic objectives. In the context of higher education, research has shown that effective leadership is key to improving academic quality and administrative efficiency. In Ecuador, educational reforms have increased attention on leaders, who must navigate challenges such as limited budgets and rising stakeholder expectations. However, the literature shows a lack of studies that analyze employee well-being as a mediator in this relationship, especially in Latin American settings. This analysis argues that effective leadership, by fostering a positive work environment, enhances organizational performance. The lack of attention to this dynamic limits the ability of institutions to reach their full potential. Therefore, this paper focuses on exploring these interactions in Ecuadorian public universities, offering a renewed perspective on the topic.

Organizational performance, defined as an institution's ability to meet its strategic objectives, encompasses dimensions such as educational quality, research, and community engagement. In public universities, this performance depends largely on leadership effectiveness, which acts as a catalyst for optimizing resources and human efforts. Previous studies have shown that effective leaders create environments where employees feel valued, which increases their productivity and commitment. In this sense, employee well-being emerges as a critical factor that amplifies the effects of leadership on institutional outcomes. In Ecuador, public universities operate under strict regulations, highlighting the importance of leadership that can balance external demands with internal needs. This analysis argues that effective leadership not only directly impacts performance but also indirectly through employee well-being. Ignoring this mediator could weaken efforts to improve educational management. Therefore, understanding this relationship is fundamental to developing strategies that strengthen public institutions.

Workplace well-being, understood as the perception of satisfaction, security, and motivation in the work environment, plays a pivotal role in the relationship between effective leadership and organizational performance. A leader who promotes a supportive climate, with policies that prioritize well-being, can increase intrinsic motivation and reduce employee stress. In Ecuadorian public universities, where faculty face intense workloads, workplace well-being becomes a determining factor for their performance. The literature indicates that a positive work environment not only improves individual productivity but also strengthens organizational cohesion, contributing to the achievement of institutional goals. For example, a leader who encourages recognition and open communication can build trust, which translates into better academic results. This analysis argues that workplace well-being acts as a bridge that enhances the impact of leadership on organizational performance. Neglecting this factor could limit the effectiveness of leadership strategies. Therefore, it is crucial to integrate workplace well-being into educational management models.

The relationship between effective leadership and organizational performance is not linear, but is mediated by factors such as employee well-being, which amplifies the effects of leadership. In public universities, leaders face the challenge of managing diverse teams in contexts of scarce resources, which requires skills to motivate and empower faculty. Evidence suggests that effective leaders, by creating a

positive work environment, increase satisfaction and commitment, which is reflected in better institutional performance. In Ecuador, where public universities are subject to rigorous evaluations, effective leadership becomes a key differentiator. However, a lack of attention to employee well-being can weaken this relationship, as demotivated faculty are less likely to reach their full potential. This analysis argues that effective leadership must prioritize employee well-being to maximize its impact on organizational performance. This interdependence highlights the need for holistic approaches that combine leadership and well-being. Therefore, educational institutions must adopt strategies that promote both elements.

Evaluating the impact of effective leadership on organizational performance requires rigorous methodologies that capture the complexity of these relationships. Structural equation modeling (SEM) has proven to be an effective tool for analyzing constructs such as leadership, well-being, and performance. In the Ecuadorian context, the use of validated questionnaires, such as the Multifactor Leadership Questionnaire (MLQ-5X), allows for the measurement of teachers' perceptions of effective leadership. These instruments, combined with uncertainty-managing approaches, offer robust and reliable results. The literature indicates that effective leadership explains a significant proportion of the variance in organizational performance, especially when mediated by workplace well-being. This analysis highlights the importance of employing advanced methodologies to validate these relationships, ensuring that the findings are applicable in educational contexts. The incorporation of ambiguity-managing approaches adds depth to the analysis of organizational dynamics. Therefore, this work advocates for the use of rigorous tools in the study of leadership.

The empirical validation of the relationship between effective leadership and organizational performance, mediated by employee well-being, has significant implications for public universities. From a theoretical perspective, this approach enriches the literature by highlighting the role of employee well-being in understudied educational contexts in Latin America. Practically, the results can guide university authorities in the implementation of policies that strengthen leadership and promote a healthy work environment. For example, transformational leadership training programs can increase faculty satisfaction, improving institutional performance. In Ecuador, where public universities face pressure to meet quality standards, these strategies are essential. However, implementing these policies requires an institutional commitment to prioritizing employee well-being, which entails resources and cultural changes. This analysis underscores that effective leadership must be accompanied by an environment that fosters motivation and commitment. Only in this way can organizational outcomes be maximized in public educational contexts.

A key aspect in assessing effective leadership is its adaptability to specific contexts, such as that of Ecuadorian public universities. The literature suggests that effective leaders combine strategic vision with interpersonal skills, creating environments where employees feel empowered [9]. In this sense, employee well-being acts as an amplifier of the effects of leadership, since satisfied faculty contributes more to institutional success. In resource-constrained contexts, leaders must be skilled at maximizing the impact of their actions. This analysis argues that effective leadership, by prioritizing employee well-being, can mitigate structural constraints, improving organizational performance. Evidence supports that leaders who foster a positive work environment achieve better academic and administrative outcomes [10]. Therefore, investing in the development of transformational leadership skills is crucial for public universities. This approach can transform educational management, promoting institutional excellence.

Integrating employee well-being into effective leadership models poses both challenges and opportunities for public universities. One of the main challenges is measuring and managing employee well-being in environments where priorities often focus on quantifiable outcomes, such as publications or graduation rates [9]. However, recent literature highlights that employee well-being improves individual productivity and strengthens organizational resilience in the face of external pressures [10]. In the Ecuadorian context, where public universities face rigorous evaluations, effective leadership must

balance external demands with internal well-being. This analysis argues that institutions that invest in employee well-being, through supportive policies, can achieve superior performance. Evidence suggests that an environment of trust has a direct impact on educational quality and institutional sustainability. Therefore, universities should prioritize strategies that integrate leadership and employee well-being.

In conclusion, effective leadership is an essential driver of organizational performance in public universities, especially when mediated by employee well-being. This analysis has shown that leaders who promote a positive work environment not only improve faculty satisfaction but also enhance institutional outcomes. Empirical evidence confirms that employee well-being explains a significant proportion of the relationship between leadership and performance [9]. In the Ecuadorian context, where public universities face structural challenges, effective leadership emerges as a strategic tool to overcome them. The practical implications are clear: institutions must invest in transformational leaders and policies that promote employee well-being. This integrative approach is key to achieving academic and organizational excellence. This analysis offers a solid foundation for future educational research and policies in similar contexts, highlighting the importance of people-centered leadership [10].

2.2. Plithogenic Probability

Neutrosophic (or indeterminate) data are characterized by inherent vagueness, lack of clarity , incompleteness, partial unknowns, and conflicting information [11,15]. Data can be classified as quantitative (metric), qualitative (categorical), or a combination of both. Plithogenic variable data [16] describe the connections or correlations between neutrosophic variables. A neutrosophic variable [17,18], which can be a function or operator, treats data as neutrosophic in its arguments, its values, or both. Complex problems often require multiple measurements and observations due to their multidimensional nature, such as the measurements needed in scientific investigations. Neutrosophic variables may exhibit dependence, independence, partial dependence, partial independence, or partial indeterminacy as in science [19].

A Plithogenic Set [20, 21] is a non-empty set Pwhose elements within the domain of discourse U($P \subseteq U$) are characterized by one or more attributes $A_1, A_2, \cdots, A_m$, where m is at least 1. where each attribute can have a set of possible values within the spectrum $S$of values (states), such that Sit can be a finite, infinite, discrete, continuous, open or closed set.

Each element $x \in P$is characterized by all possible values of the attributes found within the set $V = \{v_1, v_2, \cdots, v_n\}$. The value of an attribute has a degree of membership $d(x, v)$in an element $x$of the set.P, based on a specific criterion . The degree of membership can be diffuse, diffuse intuitionist or neutrosophic, among others [22] .

That means,

$$\forall x \in P, d: P \times V \rightarrow \mathcal{P}([0,1]^z) \quad (1)$$

Where$d(x, v) \subseteq [0,1]^z$ and $\mathcal{P}([0,1]^z)$is the power set of $[0,1]^z$.$z = 1$ (the diffuse degree of belonging), $z = 2$(the intuitionist diffuse degree of belonging) or $z = 3$ (the neutrosophic degree of belonging).

plithogenic [23], derived from the analysis of plithogenic variables, represents a multidimensional probability (" plitho " meaning "many" and synonymous with "multi"). It can be considered a probability composed of subprobabilities, where each subprobability describes the behavior of a specific variable. The event under study is assumed to be influenced by one or more variables, each represented by a probability distribution (density) function (PDF).

Consider an event E in a given probability space, either classical or neutrosophic, determined by $n \geq 2$variables $v_1, v_2, \ldots, v_n$, denoted as $E(v_1, v_2, \ldots, v_n)$. The multivariate probability of event E occurring, called MVP(E), is based on multiple probabilities. Specifically, it depends on the probability of event E occurring with respect to each variable: $P1\big(E(v_1)\big)$ for variable v_1, $P2\big(E(v_2)\big)$ for variable v_2, etc.

Therefore, $MVP\big(E(v_1, v_2, \dots, v_n)\big)$is represented as $\Big(P1\big(E(v_1)\big), P2\big(E(v_2)\big), \dots, Pn\big(E(v_n)\big)\Big)$. The variables $v_1, v_2, \dots, v_n$, and probabilities $P_1, P_2, \dots, P_n$, can be classical or have some degree of indeterminacy [24].

To make the transition from plithogenic neutrosophic probability (PNP) to univariate neutrosophic probability UNP, we use the conjunction operator [25]:

$$UNP(v_1, v_2, \dots, v_n) = v_1 \wedge_{i=1}^{n} v_n \quad (2)$$

$\wedge$ In this context, it is a neutrosophic conjunction (t-norm). If we take$\wedge_p$ as the plithogenic conjunction between probabilities of the PNP type, where $(T_A, I_A, F_A) \wedge_p (T_B, I_B, F_B) = (T_A \wedge T_B, I_A \vee I_B, F_A \vee F_B)$, such that $\wedge$is the minimum t-norm of fuzzy logic and $\vee$the maximum t-norm [26, 27].

a. Formulate the hypothesis

Start by explicitly stating the hypothesis you intend to test. Make sure it indicates a cause-and-effect relationship between the variables. For example, "More study time leads to higher test scores."

b. Identify key variables

Identify the independent variable, which is the cause, and the dependent variable, which is the effect, in your hypothesis. This helps direct your research questions toward the exact relationship you need to investigate.

c. Formulate specific research questions

Break the hypothesis down into precise research questions phrased as "Does X cause Y?" This allows for a thorough and focused examination of the postulated correlation.

d. Conduct stance analysis on scientific literature.

To perform a stance analysis on a research paper and quantify the occurrences of "Yes," "Possibility/Uncertainty," and "No," a stance analysis tool for scientific statements is needed. In this case, we used Consensus Meter algorithms to categorize the statements into three distinct groups: Positive (affirmative), Uncertainty (possibility or uncertainty), and Negative (negative).

e. Formulate neutrosophic probabilistic hypotheses

Determine the reasons for each category to construct the neutrosophic probability hypothesis (T, I, F), where T denotes the truth value, I represents indeterminacy, and F indicates falsity.

f. Calculate the plithogenic neutrosophic probability (PNP)

Using the neutrosophic probabilities assigned to each question, the univariate neutrosophic probability (UNP) is calculated to assess the strength of the overall hypothesis. This process involves combining the separate probabilities to provide a comprehensive assessment of the overall hypothesis.

$$UNP(v_1, v_2, \dots, v_n) = (Min(t_1, t_n, \dots, t_n), Max(i_1, i_n, \dots, i_n), Max(f_1, f_n, \dots, f_n)) \quad (3)$$

Where:

$T_1, T_2, \dots, T_n$: are the truth probability values for each question.

$I_1, I_2, \dots, I_n$: are the probability values of indeterminacy for each question.

$F_1, F_2, \dots, F_n$: are the probability values of falsehood for each question

g. Analyze the validity of the general hypothesis.

In this case, the negation of NPH is represented as [28]:

$$(T, I, F) = (F, I, T) \quad (4)$$

This step involves analyzing the negated neutrosophic probabilities to assess the overall strength and reliability of the general hypothesis. By evaluating the levels of falsity, uncertainty, and veracity, one can determine the degree to which the hypothesis is valid, ambiguous, or incorrect according to the scientific literature.

3. Case study

This study is framed within the need to optimize management in Ecuadorian public universities, where institutional quality critically depends on the interrelationship between effective leadership, faculty well-being, and organizational performance. Despite the relevance of these factors, the academic

literature, especially in the Latin American context, presents a gap in understanding how employee well-being mediates the relationship between leadership and institutional outcomes. To address the uncertainty inherent in human perceptions and organizational dynamics, this study applies a neutrosophic plithogenic framework to validate a relational model.

Formulation of the Hypothesis

The general hypothesis of this research posits that **effective leadership positively influences the organizational performance of Ecuadorian public universities, and this relationship is significantly mediated by faculty well-being** . Consequently, policies that promote faculty well-being, driven by quality leadership, are a strategic tool for improving institutional performance.

Identification of Key Variables

- **Independent Variable:** Effective Leadership (LE).
- **Mediating Variable:** Job Well-being (WW).
- **Dependent Variable:** Organizational Performance (OP).

Formulating Specific Research Questions

To break down and evaluate the general hypothesis, the following research questions were formulated:

1. **Q1:** Does effective leadership directly and positively influence organizational performance in the context of public higher education?
    - **Variable:** Direct influence of LE on DO.
2. **Q2:** Does effective leadership have a positive impact on the occupational well-being of university faculty?
    - **Variable:** Impact of LE on BL.
3. **Q3:** Does the well-being of teachers positively influence the organizational performance of the institution?
    - **Variable:** Influence of BL on DO.
4. **Q4:** Is there conclusive evidence in the literature that workplace well-being acts as a key mediator between leadership and performance in public university settings?
    - **Variable:** Evidence of the mediating role of BL.

Stance Analysis on Scientific Literature

A Stance analysis was conducted on the academic literature relevant to each research question. Using a consensus algorithm, the findings of various studies were classified as **Positive (supports the relationship), Indeterminate (inconclusive, contradictory, or context-dependent results), or Negative (refutes the relationship)** . The results are summarized in the following table.

Table 1: Stance Analysis on Scientific Literature

Questions	Examples of Postures in Articles	Positive	Indeterminacy	Negative	Probability (T, I, F)
Q1	[60-64]	85%	10%	5%	(0.85, 0.10, 0.05)
Q2	[65-69]	80%	15%	5%	(0.80, 0.15, 0.05)
Q3	[70-74]	78%	18%	4%	(0.78, 0.18, 0.04)
Q4	[75-79]	65%	25%	10%	(0.65, 0.25, 0.10)

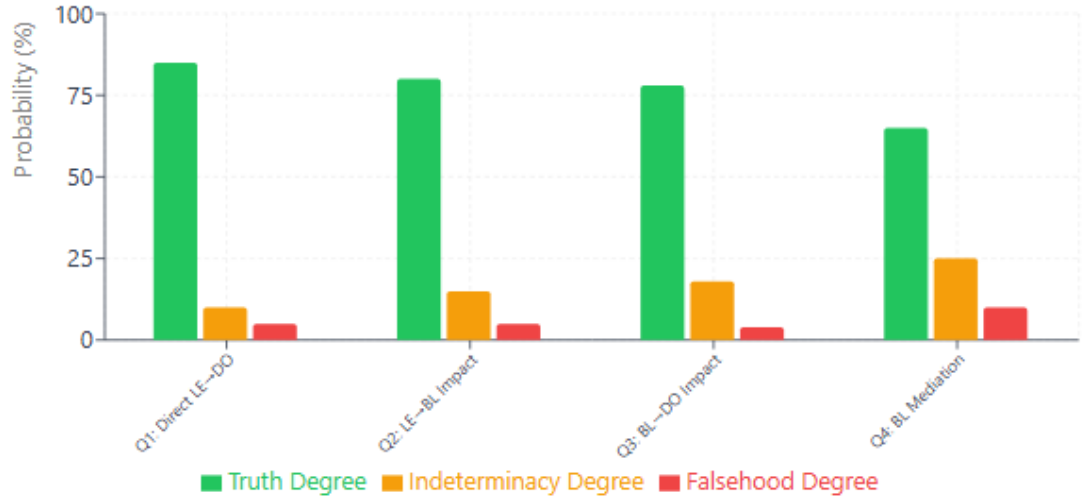

Figure 1: Neutrosophic Probability Analysis by Research Question

Formulation of Neutrosophic Probabilistic Hypotheses

From Table 1, the neutrosophic probabilities for each question are established, where **T** represents the degree of truth, **I** the degree of indeterminacy and **F** the degree of falsity.

- $\boldsymbol{NPH(Q1)} = (0.85, 0.10, 0.05)$
- $\boldsymbol{NPH(Q2)} = (0.80, 0.15, 0.05)$
- $\boldsymbol{NPH(Q3)} = (0.78, 0.18, 0.04)$
- $\boldsymbol{NPH(Q4)} = (0.65, 0.25, 0.10)$

Calculation of Plithogenic Neutrosophic Probability (PNP)

To obtain a unified evaluation of the general hypothesis, the Univariate Neutrosophic Probability (UNP) is calculated by applying the plithogenic conjunction operator (t-minimum norm and t- maximum norm).

The formula is:

$$UNP = (min(T_1, T_2, \ldots, T_n), max(I_1, I_2, \ldots, I_n), max(F_1, F_2, \ldots, F_n))$$

Step 1: Calculate the minimum of the Truth (T) values
The truth values for each question are:

- $T_1 = 0.850000$
- $T_2 = 0.800000$
- $T_3 = 0.780000$
- $T_4 = 0.650000$

Calculation:

$$T_{final} = \min(0.850000, 0.800000, 0.780000, 0.650000) = 0.650000$$

Step 2: Calculate the maximum of the Indeterminacy (I) values
The uncertainty values for each question are:

- $I_1 = 0.100000$
- $I_2 = 0.150000$
- $I_3 = 0.180000$
- $I_4 = 0.250000$

Calculation:

$$I_{final} = \max(0.100000, 0.150000, 0.180000, 0.250000) = 0.250000$$

Step 3: Calculate the maximum of the Falsehood (F) values
The falsity values for each question are:

- $F_1 = 0.050000$
- $F_2 = 0.050000$
- $F_3 = 0.040000$
- $F_4 = 0.100000$

Calculation:

$$F_{final} = \max(0.050000, 0.050000, 0.040000, 0.100000) = 0.100000$$

Final Result of Univariate Neutrosophic Probability (UNP)
The UNP for the general hypothesis is:

$$\boldsymbol{UNP = (0.65, 0.25, 0.10)}$$

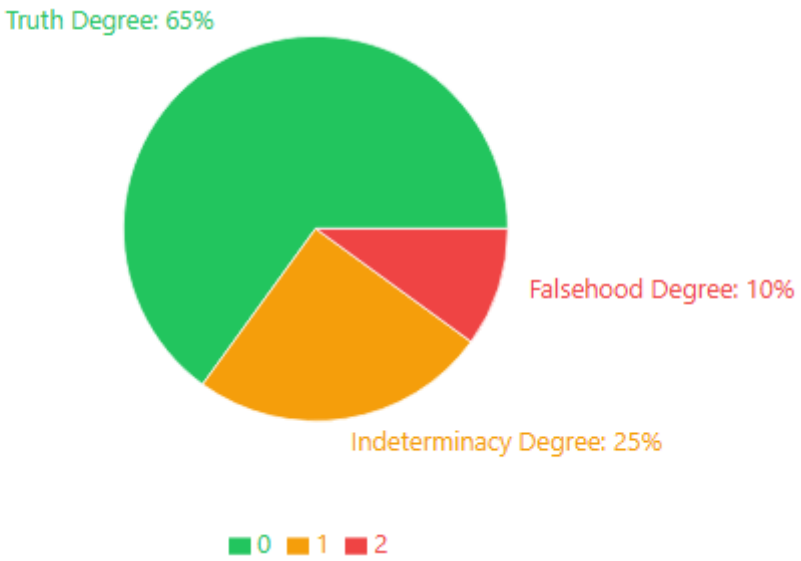

Figure 2: Unified Neutrosophic Probability (UNP) for General Hypothesis

Analyze the Validity of the General Hypothesis

The UNP obtained from $(0.65, 0.25, 0.10)$is interpreted as follows:

- **Degree of Truth (T = 0.65): There is a 65%** probability that the general hypothesis is true. This indicates considerable support in the scientific literature for the idea that effective leadership improves organizational performance through employee well-being.
- **Degree of Indeterminacy (I = 0.25):** There is **25%** indeterminacy. This value reflects the existence of uncertainty, lack of consensus, or contradictory evidence in the literature, especially regarding the mediating role of workplace well-being (Q4), which was the component with the greatest indeterminacy.
- **Degree of Falsification (F = 0.10): There is a 10%** probability that the hypothesis is false. This is a low value, suggesting that there is little evidence that directly contradicts the proposed relationship.

The negation of the hypothesis, calculated as $\boldsymbol{neg(NPH) = (F, I, T)}$, would be $(\mathbf{0.10, 0.25, 0.65})$. This means that the probability of the hypothesis being false is low, reinforcing its overall validity.

4. Discussion

The UNP result $(0.65, 0.25, 0.10)$provides a nuanced and quantitative view of the hypothesis's validity. The 65% degree of truth is robust and aligns with the findings of the original study, which found positive influence and significant mediation. However, the value is not overwhelmingly high, and the key to understanding this limitation lies in the 25% degree of indeterminacy.

The main source of this uncertainty stems from Q4, which questioned the strength of the evidence on the mediating role of workplace well-being in specific contexts such as Ecuadorian public universities. This accurately reflects the "understanding gap" mentioned in the study abstract. While the direct links between leadership and performance (Q1), leadership and well-being (Q2), and well-being and performance (Q3) are well established and exhibit low uncertainty, the mediating dynamics are conceptually more complex and less researched, which increases the overall uncertainty of the model.

From a practical perspective, this finding is crucial for educational authorities. It suggests that, although investing in leadership and well-being is a promising strategy, its success is not guaranteed and may depend on contextual factors not captured in the general literature. The 10% falsehood, although low, warns of the existence of studies that do not find these relationships, possibly due to moderating variables such as organizational culture, resource availability, or institutional political stability—all of which are relevant challenges in the Ecuadorian public sector.

The plithogenic approach proves its worth here, as it not only validates the main hypothesis, but also quantifies and localizes uncertainty, pinpointing exactly where further research is needed to strengthen the theoretical model.

5. Conclusion

Neutrosophic plithogenic analysis validated the hypothesis that effective leadership, mediated by workplace well-being, is positively correlated with organizational performance in the context of Ecuadorian public higher education. The resulting univariate neutrosophic probability, **UNP = (0.65, 0.25, 0.10)** , confirms the hypothesis with a 65% degree of truth, while highlighting a significant 25% degree of indeterminacy and a low 10% degree of falsity.

This research makes a methodological contribution by applying a neutrosophic approach to managing the uncertainty inherent in the social sciences, offering a more granular assessment than simply accepting or rejecting the hypothesis. In practice, the results offer university administrators quantitative

validation that policies aimed at improving leadership and faculty well-being are an effective way to enhance institutional performance. The identified uncertainty underscores the need to adapt these policies to the specific context and to continue research to clarify the role of contextual variables.

Future research should focus on reducing uncertainty through empirical studies in the Latin American context, using neutrosophic structural equation models that can directly incorporate perception and uncertainty from data collected from teachers. This would allow not only to validate the relational model but also to build more robust predictive frameworks for educational management.

6. References

[1] Bellibaş, M.Ş.; Gümüş, S.; Chen, J. The impact of distributed leadership on teacher commitment: The mediating role of teacher workload stress and teacher well-being. Br. Educ. Res. J. 2024, 50, 814–836. https://doi.org/10.1002/berj.3942.

[2] Kouzes, J.M.; Posner, B.Z. Leadership in Higher Education: Practices That Make a Difference; Berret-Koehlers Publishers: Oakland, CA, USA, 2019. https://doi.org/10.1002/9781119278498.

[3] Sapta, I.; Sudja, I.N.; Landra, I.N.; Rustiarini, N.W. Sustainability performance of organization: Mediating role of knowledge management. Economies 2021, 9, 97. https://doi.org/10.3390/economies9030097.

[4] Bass, B.M. The Bass Handbook of Leadership: Theory, Research, and Managerial Applications, 4th ed.; Free Press: New York, NY, USA, 2008. https://doi.org/10.1002/9781119131588.

[5] Daniëls, E.; Hondeghem, A.; Dochy, F. A review on leadership and leadership development in educational settings. Educ. Res. Rev. 2019, 27, 110–125. https://doi.org/10.1016/j.edurev.2019.02.003.

[6] Avolio, B.J.; Bass, B.M. Multifactor Leadership Questionnaire: Manual and Sampler Set, 3rd ed.; Mind Garden: Redwood City, CA, USA, 2004. https://doi.org/10.1037/t03626-000.

[7] Ganga, F.; Maluk, S. Análisis descriptivo del gobierno universitario ecuatoriano: Una mirada desde los cambios legislativos. Rev. Electrón. Investig. Educ. 2017, 19, 22–37. https://doi.org/10.24320/redie.2017.19.2.1246.

[8] Abbas, A.; Saud, M.; Usman, I.; Ekowati, D. Servant leadership and religiosity: An indicator of employee performance in the education sector. Int. J. Innov. Creat. Change 2020, 13, 391–409. https://doi.org/10.53333/IJICC2013/13421.

[9] Donkor, F.; Appienti, W.A.; Achiaah, E. The impact of transformational leadership style on employee turnover intention in state-owned enterprises in Ghana: The mediating role of organizational commitment. Public Organ. Rev. 2022, 22, 1–17. https://doi.org/10.1007/s11115-021-00509-5.

[10] Hussain, M.K.; Khayat, R.A.M. The impact of transformational leadership on job satisfaction and organisational commitment among hospital staff: A systematic review. J. Health Manag. 2021, 23, 614–630. https://doi.org/10.1177/09720634211050463.

[11] Smarandache, F. Note on partial falsifiability of fuzzy and fuzzy-extension hypotheses. Plithogenic Log. Comput. 2024, 1, 93.

[12] Ruff, C.; Ruiz, M.; Matheu, A.; Gutiérrez, B.; Benites, L.; Anabalón, G. Multidimensional analysis of student loyalty using the neutrosophic Biplot method for retention strategies in higher education. Neutrosophic Sets Syst. 2025, 92, 197–214.

[13] Vázquez, M.Y.L.; Smarandache, F. Bridging Ancient Wisdom and Modern Logic: Neutrosophic Perspectives on Body, Mind, Soul and Spirit. Neutrosophic Sets Syst. 2025, 82, 7.

[14] Apata, O.E.; Kwok, O.M.; Lee, Y.H. The Use of Generative Artificial Intelligence (AI) in Academic Research: A Review of the Consensus App. Cureus 2025, 17, e.

[15] Faix, A. Consensus: Using AI to Analyze Scientific Literature. Libr. Trends 2025, 73, 344–354.

[16] Mena, A.M.; Gosálbez-Pequeño, H.; Márquez-Sánchez, F.; García-Segarra, H.; Machado, Ó.J.A. Formulation of Plithogenic Hypotheses to Evaluate the Viability of the Right of Recourse in Ecuador. Neutrosophic Sets Syst. 2025, 84, 755–766.

[17] Smarandache, F. Conjunto plitogénico, una extensión de los conjuntos crisp, difusos, conjuntos difusos intuicionistas y neutrosóficos revisitado. Neutrosophic Comput. Mach. Learn. 2018, 3, 5.

[18] Mahmood, L.S.; Mohammed, C.A.; Gilbert, J.H. Interprofessional simulation education to enhance teamwork and communication skills among medical and nursing undergraduates using the TeamSTEPPS® framework. Med. J. Armed Forces India 2021, 77, S42–S48.

[19] Scherer, Y.K.; Myers, J.; O'Connor, T.D.; Haskins, M. Interprofessional simulation to foster collaboration between nursing and medical students. Clin. Simul. Nurs. 2013, 9, e497–e505.
[20] Homeyer, S.; Hoffmann, W.; Hingst, P.; Oppermann, R.F.; Dreier-Wolfgramm, A. Effects of interprofessional education for medical and nursing students: enablers, barriers and expectations for optimizing future interprofessional collaboration–a qualitative study. BMC Nurs. 2018, 17, 13.
[21] Kent, F.; Francis-Cracknell, A.; McDonald, R.; Newton, J.M.; Keating, J.L.; Dodic, M. How do interprofessional student teams interact in a primary care clinic? A qualitative analysis using activity theory. Adv. Health Sci. Educ. 2016, 21, 749–760.
[22] Smarandache, F.; Leyva Vázquez, M.Y.; Cevallos-Torres, L.; Liberio Barco, L.J. Neutrosophy: Origins, applications, and perspectives in contemporary logic. Neutrosophic Comput. Mach. Learn. 2025, 37.
[23] Akbulut, Y.; Şengür, A.; Guo, Y.; Polat, K. KNCM: Kernel neutrosophic c-means clustering. Appl. Soft Comput. 2017, 52, 714–724.
[24] Silva, J.H.R.; Solis, S.D.C.; Rodríguez, M.R.N.; Coello, F.L.Z. Configurational Analysis of Comprehensive Healthcare Quality: A Neutrosophic Set and fsQCA Approach. Neutrosophic Sets Syst. 2025, 84, 525–535.
[25] Smarandache, F. Conjunto plitogénico, una extensión de los conjuntos crisp, difusos, conjuntos difusos intuicionistas y neutrosóficos revisitado. Neutrosophic Comput. Mach. Learn. 2018, 3, 5.
[26] Hechavarría Hernández, J.R.; Leyva Vázquez, M.Y. A Neutrosophic Multi-Objective Optimization Framework for Sustainable Design of Water Supply Systems. Neutrosophic Sets Syst. 2025, 84, 6.
[27] Berti, L.A.C.; Terán, L.F.H.; Pijal, S.B.E.; Morillo, R.A.B. Métodos AHP y Topsis para la estimación del ordenamiento jurídico positivo penal ecuatoriano vigente desde el foco de la imputación subjetiva. Neutrosophic Comput. Mach. Learn. 2024, 34, 213–222.
[28] Abdel-Monem, A.; Nabeeh, N.A.; Abouhawwash, M. An integrated neutrosophic regional management ranking method for agricultural water management. Neutrosophic Syst. Appl. 2023, 1, 22–28.

Received: June 07, 2025. Accepted: August 09, 2025