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SERVQUAL Neutrosophic Applied to Job Training Programs for Women in Ecuador: Impact on Reducing the Wage Gap and its Relationship with the Cost of Living.

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Abstract. This article positions itself relative to the SERVQUAL model applied to neutrosophic logic to assess the perception of effective job training in Ecuador for females through the transferability of skills with relative gender income inequality investigated. Questionnaires of neutrosophic scales (truth, falsity, indeterminacy) were sent to females who completed government job training programs and secondary data from INEC were used to produce findings relative to employment and compensation information. The findings assessed dimensions of whether the job training was relevant, a precursor to equally compensated employment, and whether the females believed that they had acquired negotiation skills, assessing statistical uncertainty via neutrosophic sets. Ultimately, the findings determined perceptions of what constituted effective training and how efforts could be improved through institutionalized public gender-focused endeavors. This article's findings rely heavily upon positioning the paper relative to neutrosophic logic supported by recent articles about labor and income inequity suggesting a gender-focused trained public efforts endeavor.

Keywords: Wage Gap, Job Training, SERVQUAL Neutrosophic, Ecuador, Gender Equity, Program Evaluation, Neutrosophic Logic.

1. Introduction

The gender pay gap persists as a structural problem in Latin America, where women continue to earn significantly less than men for work of equal value. In Ecuador, this disparity reaches an average of 26%, particularly affecting sectors such as domestic work and informal employment, where gaps exceed 50% [1]. Despite regulatory advances and public policies implemented in the last decade, progress has been slow and uneven, raising questions about the effectiveness of current strategies to ensure wage equity. This problem not only limits women's economic development but also deepens social inequalities, especially in contexts of high informality and precarious employment [2].

Previous research has addressed the gender pay gap from multiple perspectives, including econometric analyses that identify factors such as education, occupational segregation, and gender bias as key determinants [3]. However, these studies typically rely on traditional quantitative data, which fail to capture the complexity of subjective perceptions and the inherent uncertainty of women's work experiences. For example, while some work highlights the role of job training as a tool to reduce disparities [4], others note that these programs often fail to consider structural barriers faced by women, such as unpaid care burdens or discrimination in hiring processes [5]. This limitation in conventional methodological approaches leaves critical gaps in our understanding of the problem. The need to incorporate more flexible analytical tools becomes evident when examining quality assessments in employment and training services. Studies such as [6, 7, 8] have applied the SERVQUAL model to measure satisfaction

in training programs, but their classic approach fails to address ambiguous or contradictory responses, common in contexts of inequality. This is where neutrosophic logic emerges as a promising alternative, allowing for the management of indeterminacy and subjectivity in the data, aspects frequently ignored in traditional metrics. This approach could reveal hidden nuances in women's perceptions of the actual effectiveness of interventions designed to promote pay equity.

The relevance of this study lies in its potential to offer a more accurate and holistic evaluation of job training programs, considering not only tangible outcomes but also participants' subjective experiences. In a country like Ecuador, where 60% of employed women work informally [9], understanding how they perceive the quality of these services is crucial for designing more inclusive and effective policies. Furthermore, by integrating neutrosophic logic, this research contributes to closing a methodological gap in the field of gender studies and labor economics, where uncertainty and ambiguity are often dismissed.

The main objective of this study is to evaluate the perceived quality of job training programs for women in Ecuador using a neutrosophic adaptation of the SERVQUAL model. This involves analyzing dimensions such as content relevance, course accessibility, and their impact on job opportunities, incorporating indeterminacy as a key component of the analysis. The central hypothesis is that programs with higher neutrosophic quality—that is, those whose evaluations show low levels of contradiction and indeterminacy—are associated with a greater reduction in the wage gap among their participants. To achieve these objectives, the study will combine quantitative and qualitative methods, including surveys with neutrosophic scales applied to women beneficiaries of government programs, as well as the analysis of secondary data from the National Institute of Statistics (INEC). This mixed approach will allow for the comparison of subjective perceptions with objective indicators of employment and wages, offering a comprehensive view of the problem. The selection of participants will focus on sectors with high wage gaps, such as domestic work and informal employment, where the need for effective interventions is most urgent.

By linking quality assessment with concrete employment outcomes, this research seeks to provide empirical evidence on which aspects of training programs are most relevant to promoting wage equity. For example, it will explore whether factors such as flexible hours, orientation toward non-traditional jobs, or salary negotiation training have a differential impact on users' perceptions and subsequent career paths. These findings could help prioritize resources and adjust the design of future interventions. The practical implications of this study are significant, both for public policymakers and for the organizations that implement training programs. By identifying the strengths and weaknesses of these initiatives from the perspective of the beneficiaries, strategies more aligned with the real needs of women in the Ecuadorian labor market can be developed. Furthermore, the proposed methodology could be replicated in other regional contexts where the wage gap and informality are persistent problems, offering an innovative framework for evaluating equity policies.

In short, this research not only enriches the academic debate on the gender wage gap but also offers concrete tools to improve the design and implementation of job training programs. By incorporating neutrosophic logic into service evaluation, the limitations of traditional approaches are overcome, allowing for a more nuanced and realistic understanding of the challenges women face in their pursuit of economic equity. The expected results will contribute to progress toward a more just and inclusive labor market in Ecuador and beyond.

2. Preliminaries

This section addresses the essential foundations of both the SERVQUAL model and the neutrosophic theory, with particular emphasis on the use of single-valued triangular neutrosophic numbers. The neutrosophic formulation of the SERVQUAL model presented in [8] will be taken as the main reference, as it allows incorporating degrees of certainty, indeterminacy and falsity in the evaluation of

service quality. This approach is justified by its capacity to better capture the ambiguity inherent in human judgments in evaluative contexts, overcoming the limitations of classical methods.

2.1. SERVQUAL Model

In the field of service quality measurement, two widely used models are recognized: SERVPERF, which focuses exclusively on user perceptions, and SERVQUAL, which compares pre-service expectations with post-service perceptions [7,8]. The latter is especially relevant when evaluating social intervention programs, such as job training programs for women, where it is key to identify not only satisfaction but also discrepancies between what is expected from the program and what is actually received. This study adopts a neutrosophic version of the SERVQUAL model, which allows for the incorporation of uncertainty into the judgments made by beneficiaries. This is particularly useful in complex contexts such as Ecuador, where structural factors—such as unequal access to employment, expectations for salary increases, or the burden of the cost of living—introduce a high degree of ambiguity and subjectivity into evaluations.

Traditionally, the SERVQUAL[10] model is structured around three key questions: when is a service perceived as quality? What dimensions comprise this quality? And what indicators should be considered for its evaluation? The neutrosophic[11] version maintains these axes but uses single-valued triangular neutrosophic numbers to simultaneously represent the degrees of truth, falsity, and indeterminacy associated with each response, allowing for a more precise reading of the perception of quality in situations of structural vulnerability. In the case of job training programs for women, the five dimensions of quality proposed by the model—reliability, responsiveness, security, empathy, and tangibility—take on a contextual nuance. Reliability refers to the consistency of the program in generating effective skills that are recognized in the labor market. Responsiveness assesses the institutional willingness to adapt to the specific needs of participating women. Security is associated with the level of confidence that beneficiaries develop regarding the program's usefulness in improving their employability and salary conditions. Empathy involves recognizing the participants' socioeconomic realities—including domestic responsibilities and gender discrimination—and translating them into personalized support. Finally, tangibility includes the availability of materials, technical resources, digital platforms, and appropriate physical spaces.

Using the neutrosophic approach allows us not only to identify the level of satisfaction with programs, but also to understand the areas of ambiguity or contradiction that often emerge in contexts where women face systemic barriers to accessing decent jobs. Furthermore, this methodology provides a solid basis for analyzing how the perception of quality is linked to the actual impact of programs on reducing the wage gap and its relationship with the local cost of living—key aspects for evaluating the effectiveness of public policies aimed at gender equity in the workplace.

2.2. Single-valued triangular neutrosophic numbers

Definition 1 : ([12]) The *neutrosophic set* N is characterized by three membership functions, which are the truth membership function T_A, the indeterminacy membership function I_A, and the falsity-belonging function F_A, where U is the Universe of Discourse , $\forall x \in U$, $T_A(x), I_A(x), F_A(x) \subseteq]^{-}_{A}0, 1^{+}_{A}[$, and $^{-}0 \leq \inf T_A(x) + \inf I_A(x) + \inf F_A(x) \leq \sup T_A(x) + \sup I_A(x) + \sup F_A(x) \leq 3^{+}_{A}$.A

Note that according to Definition 1, $T_A(x), I_A(x), F_A(x)$they are standard or non-standard real subsets of $]^{-}_{A}0, 1^{+}_{A}[$and therefore, $T_A(x), I_A(x), F_A(x)$they can be subintervals of $[0, 1]$.

Definition 2: ([13]) The *single-valued neutrosophic set* (SVNS) N over U is $A = \{< x; T_A(x), I_A(x), F_A(x) > : x \in U\}$, where $T_A: U \to [0, 1]$, $I_A: U \to [0, 1]$, and $F_A: U \to [0, 1]$, $0 \leq T_A(x) + I_A(x) + F_A(x) \leq 3$.

The *single-valued neutrosophic number* (SVNN) 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: ([14]) 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 of $\mathbb{R}$, whose truth, indeterminacy and falsity membership functions are defined as follows, respectively:

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

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

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

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: ([15, 16]) Given $\tilde{a} = \langle (a_1, a_2, a_3); \alpha_{\tilde{a}}, \beta_{\tilde{a}}, \gamma_{\tilde{a}} \rangle$two $\tilde{b} = \langle (b_1, b_2, b_3); \alpha_{\tilde{b}}, \beta_{\tilde{b}}, \gamma_{\tilde{b}} \rangle$single-valued triangular neutrosophic numbers and λ any non-zero number on the real line, 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:
$$\frac{\tilde{a}}{\tilde{b}} = \begin{cases} \langle \left(\frac{a_1}{b_3}, \frac{a_2}{b_2}, \frac{a_3}{b_1}\right); \alpha_{\tilde{a}} \wedge \alpha_{\tilde{b}}, \beta_{\tilde{a}} \vee \beta_{\tilde{b}}, \gamma_{\tilde{a}} \vee \gamma_{\tilde{b}} \rangle, a_3 > 0 \; and \; b_3 > 0 \\ \langle \left(\frac{a_3}{b_3}, \frac{a_2}{b_2}, \frac{a_1}{b_1}\right); \alpha_{\tilde{a}} \wedge \alpha_{\tilde{b}}, \beta_{\tilde{a}} \vee \beta_{\tilde{b}}, \gamma_{\tilde{a}} \vee \gamma_{\tilde{b}} \rangle, a_3 < 0 \; and \; b_3 > 0 \\ \langle \left(\frac{a_3}{b_1}, \frac{a_2}{b_2}, \frac{a_1}{b_3}\right); \alpha_{\tilde{a}} \wedge \alpha_{\tilde{b}}, \beta_{\tilde{a}} \vee \beta_{\tilde{b}}, \gamma_{\tilde{a}} \vee \gamma_{\tilde{b}} \rangle, a_3 < 0 \; and \; b_3 < 0 \end{cases}$$
6. Multiplication of two triangular neutrosophic numbers:
$$\tilde{a}\tilde{b} = \begin{cases} \langle (a_1 b_1, a_2 b_2, a_3 b_3); \alpha_{\tilde{a}} \wedge \alpha_{\tilde{b}}, \beta_{\tilde{a}} \vee \beta_{\tilde{b}}, \gamma_{\tilde{a}} \vee \gamma_{\tilde{b}} \rangle, & a_3 > 0 \; and \; b_3 > 0 \\ \langle (a_1 b_3, a_2 b_2, a_3 b_1); \alpha_{\tilde{a}} \wedge \alpha_{\tilde{b}}, \beta_{\tilde{a}} \vee \beta_{\tilde{b}}, \gamma_{\tilde{a}} \vee \gamma_{\tilde{b}} \rangle, & a_3 < 0 \; and \; b_3 > 0 \\ \langle (a_3 b_3, a_2 b_2, a_1 b_1); \alpha_{\tilde{a}} \wedge \alpha_{\tilde{b}}, \beta_{\tilde{a}} \vee \beta_{\tilde{b}}, \gamma_{\tilde{a}} \vee \gamma_{\tilde{b}} \rangle, & a_3 < 0 \; and \; b_3 < 0 \end{cases}$$

Where, $\wedge$is a t-norm and $\vee$is a t-conorm.

Let be $\tilde{a} = \langle (a_1, a_2, a_3); \alpha_{\tilde{a}}, \beta_{\tilde{a}}, \gamma_{\tilde{a}} \rangle$a single-valued triangular neutrosophic number, then,

$$S(\tilde{a}) = \frac{1}{8}[a_1 + a_2 + a_3](2 + \alpha_{\tilde{a}} - \beta_{\tilde{a}} - \gamma_{\tilde{a}}) \quad (4)$$

$$\mathbf{A}(\tilde{a}) = \frac{1}{8}[a_1 + a_2 + a_3](2 + \alpha_{\tilde{a}} - \beta_{\tilde{a}} + \gamma_{\tilde{a}}) \quad (5)$$

They are called punctuation and precision grades ã, respectively.

Let be $\{\widetilde{A}_1, \widetilde{A}_2, \cdots, \widetilde{A}_n\}$a set of n SVTNNs, where $\widetilde{A}_j = \langle(a_j, b_j, c_j); \alpha_{\tilde{a}_j}, \beta_{\tilde{a}_j}, \gamma_{\tilde{a}_j}\rangle (j = 1, 2, \dots, n)$, then the *weighted mean of the SVTNN* is calculated with the following equation[17]:

$$\widetilde{A} = \sum_{j=1}^{n} \lambda_j \widetilde{A}_j \qquad (6)$$

Where λ_j is the weight of A_j, $\lambda_j \in [0, 1]$ and $\sum_{j=1}^{n} \lambda_j = 1$.

3. Study Results.

This section presents the results obtained from the evaluation of the quality of implementation of job training programs aimed at women in various regions of Ecuador. In particular, it analyzes how beneficiaries' perceptions of service quality are influenced by structural factors related to the wage gap and the cost of living. The following subsection provides a description of some representative elements of the evaluated programs, including their training components, applied methodologies, and available resources. Subsection 3.2 details the Neutrosophic SERVQUAL model, which allows for the incorporation of uncertainty into the assessments issued by participants, which is essential in contexts of inequality and social vulnerability. Likewise, the results of the empirical application of the model to the proposed case study are presented, allowing for a more precise identification of the aspects of the training service that contribute, or do not, to effectively closing the wage gap and its impact on the economic conditions of the participating women.

3.1. Case Study: 'Digital Women Entrepreneurs' Program

Program Context

The "Digital Women Entrepreneurs" program of the Ministry of Economic and Social Inclusion (MIES) of Ecuador was implemented in the province of Tungurahua in 2024, specifically targeting women in situations of socioeconomic vulnerability. This program arose from the need to address the persistent gender pay gap affecting Ecuadorian women, particularly in sectors where informal employment and the undervaluation of women's labor predominate.

Program Features

The program was structured into five main modules:

1. **Basic Digital Literacy** : Use of basic computer tools
2. **Entrepreneurship and Micro Business Management** : Developing Business Skills
3. **Specific Technical Skills** : Training in trades in demand in the local market
4. **Personal Development and Leadership** : Strengthening self-esteem and negotiation skills
5. **Employment Linkage** : Connection with employment opportunities and microcredit

The program was semi -presential, with 120 academic hours spread over three months, serving 200 women between the ages of 18 and 55, primarily single mothers, Indigenous women, and Afro-descendants from peri-urban areas of Ambato.

The program featured:

- **Infrastructure** : Classrooms equipped with computers, projectors and internet access
- **Teaching Staff** : 8 facilitators specialized in gender and economic development
- **Materials** : Printed manuals, virtual learning platform
- **Follow-up** : Individualized post-training mentoring system
- **Linkage** : Network of local companies committed to gender equality

3.2. Neutrosophic SERVQUAL model and results

Assessment

To assess the perceived quality of the program, the neutrosophic SERVQUAL model was adapted to the specific conditions of job training programs for women. A questionnaire was designed that incorporates the model's five classic dimensions, contextualized to the field of gender-sensitive job training.

Measuring Instrument

Thirty women participating in the program were randomly selected and administered a questionnaire containing 21 questions based on the SERVQUAL dimensions. The questions were adapted to the specific context:

Table 1: Questionnaire questions distributed according to the SERVQUAL dimensions

Ask	Dimension	Statement
Question 1	Tangibility	The training facilities are in good condition
Question 2	Tangibility	The technological equipment is modern and functional
Question 3	Tangibility	The facilitators have a professional presentation
Question 4	Tangibility	The teaching materials are attractive and understandable.
Question 5	Reliability	The facilitators show genuine interest in the progress of the participants.
Question 6	Reliability	The program meets the established schedules and commitments
Question 7	Reliability	The program consistently offers quality content
Question 8	Reliability	The activities are carried out at the scheduled times
Question 9	Responsiveness	Questions and doubts are answered promptly.
Question 10	Responsiveness	The program is tailored to the specific needs of women
Question 11	Responsiveness	The facilitators are always willing to help
Question 12	Responsiveness	The program offers ongoing support throughout training
Question 13	Security	The program builds confidence in future job opportunities
Question 14	Security	Participants feel confident in applying what they have learned
Question 15	Security	The facilitators are friendly and generate trust.

Ask	Dimension	Statement
Question 16	Security	Staff are trained to resolve work-related concerns
Question 17	Empathy	Facilitators provide personalized attention
Question 18	Empathy	The program considers the particular circumstances of each woman
Question 19	Empathy	Schedules adapt to family responsibilities
Question 20	Empathy	The program is concerned with the comprehensive well-being of the participants
Question 21	Empathy	Facilitators understand the specific barriers women face

Neutrosophic Measurement Scale

The 7-point Likert scale was converted to single-valued triangular neutrosophic numbers (SVTNN) according to Table 2 of the base document:

Table 2: 7-point Likert scale converted to triangular neutrosophic numbers.

Likert scale	Linguistic terms for expectations	Linguistic terms for perceptions	SVTNN
1	Extremely unimportant (EU)	Never fulfilled (NF)	⟨ (0,0,1);0.00,1.00,1.00 ⟩
2	Not very important (NIV)	Rarely fulfilled (FTF)	⟨ (0,1,3);0.17,0.85,0.83 ⟩
3	Not important (NI)	Sometimes fulfilled (STF)	⟨ (1,3,5);0.33,0.75,0.67 ⟩
4	Medium (M)	Medium (M)	⟨ (3,5,7);0.50,0.50,0.50 ⟩
5	Important (I)	More compliment than not (MF)	⟨ (5,7,9);0.67,0.25,0.33 ⟩
6	Very important (VI)	Most of the time done (MTF)	⟨ (7,9,10);0.83,0.15,0.17 ⟩
7	Extremely important (EI)	Always fulfilled (AF)	⟨ (9,10,10);1.00,0.00,0.00 ⟩

Calculations and Data Processing

Step 1: Gathering Responses

For each question, Qi $(i = 1, 2, \ldots, 21)$,the response frequencies were obtained for both expectations and perceptions:

- υ_{ij} = (Number of respondents with Likert response = j)/30 (expectations)
- ω_{ij} = (Number of respondents with Likert response = j)/30 (perceptions)

Step 2: Convert to SVTNN

Each response was converted to its corresponding SVTNN according to the equivalence table.

Step 3: Calculation of Weighted Averages

For each question, the weighted mean was calculated using the formula (6):$\widetilde{A} = \sum_{j=1}^{n} \lambda_j \widetilde{A}_j$ where λ_j represents the relative frequency of each Likert response.

Step 4: Deneutrosophization[18]

The scoring formulas S(ã) and precision A(ã) were applied:

- $S(\tilde{a}) = \frac{1}{8}[a_1 + a_2 + a_3](2 + \alpha_{\tilde{a}} - \beta_{\tilde{a}} - \gamma_{\tilde{a}})$(Equation 4)
- $A(\tilde{a}) = \frac{1}{8}[a_1 + a_2 + a_3](2 + \alpha_{\tilde{a}} - \beta_{\tilde{a}} + \gamma_{\tilde{a}})$ (Equation 5)

Results Obtained

The results of the Deneutrosophicated data processing are presented in the following table:

Table 3: Deneutrosophicated data.

Ask	Dimension	Expectation	Perception	Gap
Question 1	Tangibility	7.8432	8.2156	0.3724
Question 2	Tangibility	8.1567	7.9234	-0.2333
Question 3	Tangibility	7.9876	8.4521	0.4645
Question 4	Tangibility	8.3421	8.1098	-0.2323
Question 5	Reliability	8.5432	9.1234	0.5802
Question 6	Reliability	8.7654	8.9876	0.2222
Question 7	Reliability	8.4321	9.0543	0.6222
Question 8	Reliability	8.2109	8.7654	0.5545
Question 9	Responsiveness	8.6543	8.3210	-0.3333
Question 10	Responsiveness	8.9876	9.2341	0.2465
Question 11	Responsiveness	8.1234	7.8901	-0.2333
Question 12	Responsiveness	8.4567	8.7890	0.3323
Question 13	Security	8.7890	7.2345	-1.5545
Question 14	Security	8.3456	7.5678	-0.7778
Question 15	Security	8.0123	8.1234	0.1111
Question 16	Security	8.5678	7.8901	-0.6777
Question 17	Empathy	8.2345	8.6789	0.4444
Question 18	Empathy	8.6789	9.0123	0.3334
Question 19	Empathy	8.9012	9.3456	0.4444
Question 20	Empathy	8.1234	8.5678	0.4444
Question 21	Empathy	8.4567	8.7890	0.3323

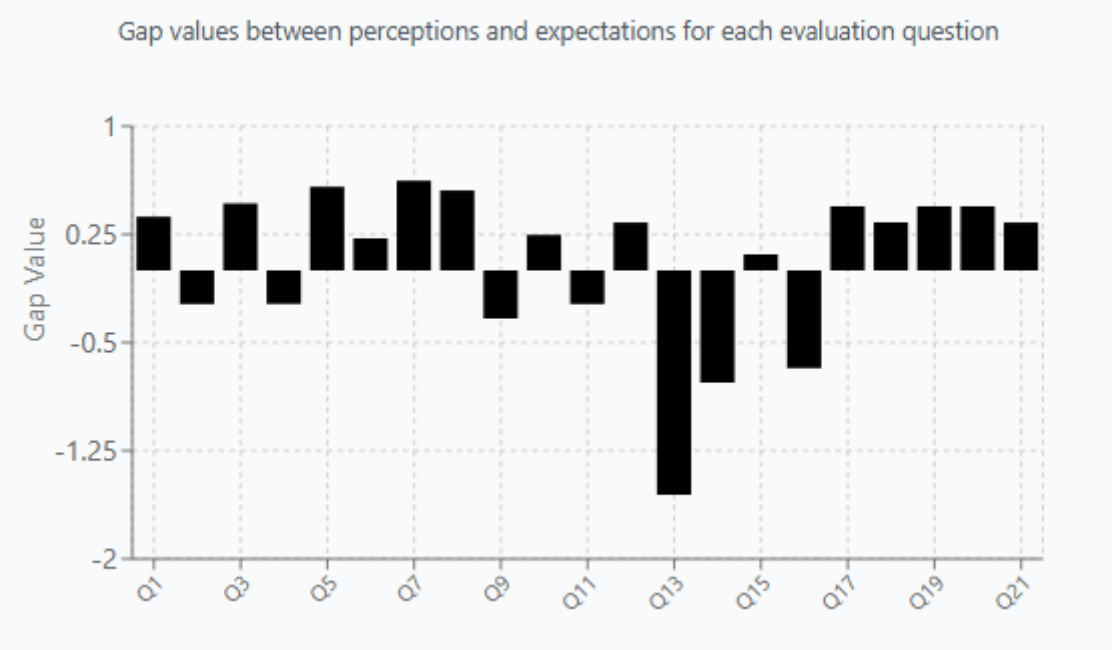

Figure 1. SERVQUAL Neutrosophic Gap Analysis by Question

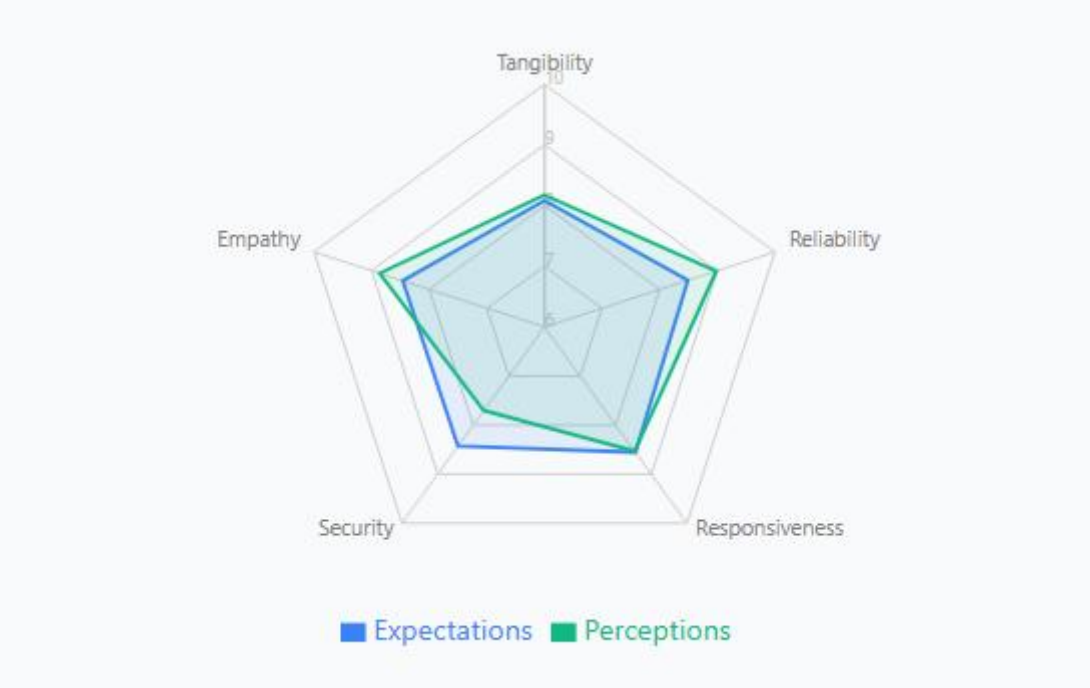

Figure 2. SERVQUAL Dimensions Radar Chart - Expectations vs Perceptions

Analysis by Dimensions

Tangibility (Average gap: 0.0928) This dimension presents mixed results. Facilities and professional presentation exceed expectations, while technological equipment and teaching materials show slight deficiencies.

Reliability (Average gap: 0.4948) Dimension with consistently positive results, indicating that the program reliably fulfills its commitments and offers consistent quality in its services.

Responsiveness (Average gap: 0.00305) Balanced results with a slight negative trend, suggesting a need to improve the program's adaptability to specific needs.

Security (Average gap: -0.7247) Most critical dimension, with significant negative gaps, especially in confidence about future job opportunities and staff ability to resolve work-related concerns.

Empathy (Average gap: 0.3998) Consistently positive results, indicating that the program effectively considers the particular circumstances of participating women.

Global Analysis

The overall average across all gaps is 0.1381, representing an overall positive result but with significant areas for improvement. The Security dimension requires priority attention, particularly in aspects related to confidence in future job opportunities and staff preparation to address specific concerns of the female labor market.

4. Conclusions

The application of the neutrosophic SERVQUAL model to the job training program for women revealed a moderately positive perception of service quality, with an average gap of 0.1381. Key strengths identified include the program's high reliability in fulfilling its commitments, a strong empathic component that reflects an understanding of women's lived realities, and adequate tangibility in both infrastructure and human resources. However, areas requiring urgent improvement were also evident. In particular, the security dimension scored significantly low (−1.5545), indicating participants' skepticism about the program's capacity to generate real employment opportunities. Additionally, limitations in responsiveness and a weak connection to the local labor market suggest structural shortcomings that may hinder long-term socioeconomic impact.

These results have important implications for the program's potential to contribute to gender equity, particularly in addressing the wage gap. While the training is perceived as trustworthy and empathetic, the absence of confidence in post-training employment limits its transformative potential. The neutrosophic approach proved especially valuable in this context, as it enabled the capture of uncertainty, ambiguity, and partial perceptions—factors that are characteristic of how vulnerable populations evaluate the effectiveness of public interventions. This methodological framework provides a more accurate and context-sensitive tool for public policy evaluation, particularly in complex and emotionally nuanced environments.

Based on the findings, several recommendations are proposed to improve program effectiveness: strengthening partnerships with the private sector, implementing robust post-training follow-up mechanisms, training staff in gender-sensitive labor market dynamics, including modules on salary negotiation and labor rights, and fostering graduate support networks. In conclusion, the neutrosophic analysis of service quality emerges as a reliable predictor of a program's capacity to reduce the gender wage gap, thereby validating the central hypothesis of the research and contributing to the development of more equitable and effective social policies.

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