



Analysis of the Impact of Soft Skills on Organizational Competitiveness in Cotopaxi through Modeling of the Plithogenic IADOV

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Abstract. Training plays an important role in the development of skills and organizational competitiveness. In Cotopaxi, a misalignment was identified between employees and organizational objectives concerning organizational performance and human development. Consequently, this study analyzed the influence of soft skills, the elimination of skill gaps, adherence to standards, and organizational alignment on job satisfaction and performance, aiming to enhance organizational competitiveness. The plithogenic IADOV method was applied to evaluate satisfaction levels and the interrelationships among these dimensions. Findings indicated significant dissatisfaction among employees across all assessed dimensions, underscoring the urgent need for training programs focused on soft skills. It was concluded that closing existing skill gaps and fostering the development of soft skills are essential steps toward reducing training needs and enhancing both organizational performance and competitiveness.

Keywords: job performance, skill development, job competencies, talent management, plithogenic IADOV.

1 Introduction

In today's business environment, characterized by high competitiveness and constant change [1], human talent training is considered a critical factor for maintaining competitiveness in productive sectors [2] [3]. Organizations recognize that success significantly depends on the development of their collaborators, who must acquire new skills and competencies to meet the dynamic challenges of the work environment [4]. Training contributes not only to employees' professional growth but also supports career planning and performance evaluation, making it a fundamental process in human resource management.

Training, as a cornerstone of organizational development, seeks to continuously enhance individual competencies, positively impacting the organization's overall performance [5]. However, this process entails inherent challenges due to the need to balance organizational goals, departmental objectives, and individual aspirations. This complexity underscores the need to align training programs with organizational objectives to maximize relevance and effectiveness. In this way, the integral growth of the organization is promoted, and productivity is increased.

In productive sectors, an adequate identification of training needs enables companies to improve work quality, increase job satisfaction, and retain talent, while employees acquire updated and relevant skills, enhancing their employability. Despite these benefits, many organizations lack a deep understanding of their collaborators' development needs. This gap hinders the design of programs that truly address skill and competency gaps, thus limiting the effectiveness of training efforts [6].

Employees' perception of their own training needs is crucial for a successful organizational development strategy [7]. In Ecuador, although training is recognized as an essential tool, individual employee perceptions are sometimes overlooked, resulting in centrally designed training programs that are disconnected from the specific needs of each worker. Identifying these needs, therefore, is an essential step to ensure that companies and their employees are well-equipped to face the challenges of a continuously evolving work environment.

The objective of identifying training needs is to increase productivity through human capital development by enabling training programs to meet the requirements demanded by each job position. This identification occurs at two levels: first, assessing the minimum knowledge and skills required for performing a specific function, and second, comparing these aspects with job requirements over various timeframes. Alignment between training needs and employees' perception of their skill gaps is crucial in designing effective programs [8].

Employees, being at the forefront of implementation, face the challenges of meeting organizational objectives, bridging skill gaps, and complying with external regulations. Their perception of these gaps and difficulties provides invaluable insight for identifying areas where training would be particularly beneficial. Additionally, each employee's professional aspirations should be considered to adapt training programs and ensure alignment with both individual growth objectives and organizational goals [9].

To optimize resources, the approach to identifying training needs must be systematic. This involves carefully planning training activities and conducting a comprehensive analysis of the areas requiring development. In this way, unnecessary training sessions are avoided, and key areas with a direct impact on organizational outcomes are addressed. A rigorous analysis allows for the prioritization of training efforts and maximizes their impact on organizational efficiency and performance [10].

Consequently, the objective of this research is to analyze how soft skills [11], the elimination of skill gaps, compliance with standards, and alignment with organizational goals influence employee satisfaction and job performance in the productive sectors of the Cotopaxi province. Additionally, this study aims to identify areas for improvement in training programs and to strengthen organizational competitiveness in the productive sector [12]. To achieve this, the plithogenic IADOV method was applied to evaluate the relationships between various dimensions and their influence on work outcomes.

2 Materials and Methods

2.1 Plithogenic IADOV

The plithogenic IADOV method is an evaluation method used to measure respondents' satisfaction. By extending this technique to plithogenic analysis and employing a neutrosophic scale [13], the ability to measure indeterminate or inaccessible aspects through conventional methods is introduced. Mathematical modeling through plithogenic logic enables the inclusion of indeterminacy and contradiction in the evaluation of sets and systems. To understand this extended method [14], it is essential to define what constitutes a plithogenic set:

Plithogenic set [15]: An extension of classical, fuzzy, intuitionistic fuzzy, and neutrosophic sets. A plithogenic set (P, a, V, d, c) :

- Where "P" represents a set, "a" is an attribute (generally multidimensional), "V" is the range of values for the attribute, and "d" is the degree of membership of each element x 's attribute value within set P according to certain criteria. The term "d" is defined as a fuzzy membership degree d_F , an intuitionistic fuzzy membership d_{IF} , or a neutrosophic membership degree d_N , respectively, for an element x in the plithogenic set P; $x \in P$.
- "c" is defined as the contradiction degree function c_F of a fuzzy attribute value, the contradiction degree function c_{IF} of an intuitionistic fuzzy attribute value, or the contradiction degree function c_N of a neutrosophic attribute value, respectively [16].
- The functions are defined according to the applications that experts need to address. $d(\cdot, \cdot)$

and $c(\cdot, \cdot)$ then use the following notation: $x(d(x, V))$, where $d(x, V) = \{d(x, v), \text{ for all } v \in V\}$, for all $x \in P$. The contradiction degree function for an attribute value is calculated between each attribute value with respect to the dominant attribute value (denoted by v_D) in particular, as well as for other attribute values v .

Thus, the Plithogenic IADOV method allows for addressing the complexity of respondents' perceptions. This requires a linguistic evaluation system adapted to the plithogenic model to accurately capture expert opinions (see Table 1). This system and its equivalents on a plithogenic scale are defined as the T-score function of a neutrosophic number, according to Smarandache's proposed formula, as shown in equation (1) [17].

$$F(T) = \frac{T + F - I}{2} \tag{1}$$

Table 1: Evaluation system for experts. Source: Own elaboration.

Linguistic term of the plithogenic IADOV	SVNN	$\mathcal{S}([T, I, F])$	w_j	IADOV
Extremely Satisfied (ES)	(1,0,0)	1.00	1.00	Clearly Satisfied
Very Very satisfied (VVS)	(0.95,0.15,0.1)	0.90	-	
Very satisfied (MS)	(0.85,0.25,0.2)	0.80	-	
Satisfied (S)	(0.75,0.35,0.3)	0.70	0.70	More satisfied than dissatisfied
Moderately satisfied (MDS)	(0.65,0.45,0.4)	0.60	-	-
Undefined (U)	(0.55,0.55,0.5)	0.50	0.5	Not defined (ND)
Moderately Dissatisfied (MDD)	(0.45,0.65,0.6)	0.40	-	-
Dissatisfied (D)	(0.35,0.75,0.7)	0.30	0.30	More dissatisfied than satisfied
Very Dissatisfied (VD)	(0.25,0.85,0.8)	0.20	-	
Very Very Dissatisfied (VVD)	(0,0.95,1)	0.05	-1.00	Clearly dissatisfied
Contradictory (C)	(1,0,1)	0	0	Contradictory

Another component specific to the method is the IADOV logic table, where the term "I" in neutrosophy is interpreted as a unit of indeterminacy. This table assigns numerical values to the closed-ended questions posed to experts. Additionally, if necessary, open-ended questions are included in the surveys. Among the questions used in this study are:

- Are you satisfied with the level of alignment between organizational objectives and your daily work within the company?
- Are you satisfied with the actions taken by your company over the past year to reduce skill gaps among employees?
- Are you satisfied with the level of compliance with standards within your organization and the support provided to follow them adequately?
- Are you satisfied with the development of soft skills within your organization and its impact on the work environment and performance?
- From your perspective, what specific actions could be taken to improve soft skill development, better align organizational objectives, optimize compliance with standards, and eliminate performance gaps within the company?

To calculate the Neutrosophic Plithogenic Global Satisfaction Index (NPGSI) of the respondents, the aggregation operator H_N^P was used, taking into account the evaluations of each element X in the plithogenic set P ; $x \in Pd_F d_{IF} d_N$. In this way, the NPGSI is obtained from the sum of the elements analyzed within the evaluated plithogenic subset, where L_r^P represents the frequency, and w_j is the assigned weight (see Equation 2).

$$H_N^P (S_1^P, S_2^P, \dots, S_n^P) = \sum_{i=1}^n [w_j, L_r^P] \tag{2}$$

3 The Study

This study employed a plithogenic scale using the plithogenic IADOV method to assess training needs in companies in Cotopaxi, focusing on employees in administrative roles. The questionnaire underwent internal validation through a pilot test (45 participants), yielding a global Cronbach's alpha coefficient of 0.854, indicating high reliability. Data adequacy was evaluated using the KMO index, which resulted in a value of 0.774, and Bartlett's sphericity test, with a p-value of 0.000, confirming the feasibility of the analysis. This analysis revealed commonalities above 0.5, validating the questionnaire dimensions as appropriate. Table 2 presents the characteristics of the analyzed plithogenic set.

Table 2: Characteristics of the Plithogenic set. Source: Own elaboration.

Plithogenic set:	Organizational performance and human development, $\forall P_{S_n} = \{S_{V_1}, S_{V_2}, \dots, S_{V_n}\}$
Plithogenic subsets (Dimensions)	<ul style="list-style-type: none"> Organizational objectives (S_1). Gap elimination (S_2). Compliance with standards (S_3). Soft skills (S_4).
Attributes:	Acceptance dimension, $\forall S_{V_{1n}} = \{S_{V_1}, S_{V_2}, S_{V_3}, S_{V_4}\}$
Variable:	Level of satisfaction of each plithogenic dimension.
Measuring scale	Plithogenic linguistic term (See Table 1).

The results of the group satisfaction analysis indicate participants' perceptions in relation to the four evaluated dimensions: organizational objectives, gap elimination, compliance with standards, and soft skills. The Group Satisfaction Index (GSI), calculated for each dimension and compared with the plithogenic IADOV evaluation system, provides an accurate view of overall satisfaction.

Among these, organizational objectives obtained a GSI of 0.75, which falls within the "Satisfied" category, situated between the levels of "more satisfied than dissatisfied" and "very satisfied (VS)" (see Table 3). This score reflects a generally positive perception regarding the alignment and fulfillment of organizational objectives with employees' expectations.

Table 3: Calculation of the GSI of the Organizational Objectives Dimension (S_1). Source: Own elaboration.

Linguistic term	SVNN	Punctuation (w_j)	Frequency (L_p^r)	$W_j \cdot L_p^r$	$\frac{W_j \cdot L_p^r}{n}$
Clearly satisfied (CS)	(1,0,0)	1.00	21	21	0.47
More satisfied than dissatisfied (MSD) (0.75,0.35,0.3)		0.70	15	10.5	0.23
Undefined (U)	I	0.50	4	2	0.04
More dissatisfied than satisfied (MDS) (0.35,0.85,0.7)		-0.30	3	-0.9	-0.02
Clearly dissatisfied (CD)	(0,0,1)	-1.00	1	-1	-0.02
Contradictory (C)	(1,0,1)	0.00	1	0	0.00
Group Satisfaction Index					0.75

Meanwhile, gap elimination reached a GSI of 0.68, also classified as "satisfied," but approaching the category of "moderately satisfied (MS)" (see Table 4). This suggests that, although progress is perceived in reducing skill and opportunity gaps, some employees believe there are still areas for improvement to promote greater equality within the organization.

Table 4: Calculating the GSI for the Gap Elimination Dimension (S_2). Source: Own elaboration.

Linguistic term	SVNN	Punctuation (w_j)	Frequency (L_p^r)	$W_j \cdot L_p^r$	$\frac{W_j \cdot L_p^r}{n}$
Clearly satisfied (CS)	(1,0,0)	17	17	0.38	17

Linguistic term	SVNN	Punctuation (w_j)	Frequency (L_p^r)	$W_j \cdot L_p^r$	$\frac{W_j \cdot L_p^r}{n}$
More satisfied than dissatisfied (MSD)	(0.75,0.35,0.3)	20	14	0.31	20
Undefined (U)	I	2	1	0.02	2
More dissatisfied than satisfied (MDS)	(0.35,0.85,0.7)	1	-0.3	-0.01	1
Clearly dissatisfied (CD)	(0,1,1)	1	-1	-0.02	1
Contradictory (C)	(1,0,1)	4	0	0.00	4
Group Satisfaction Index					0.68

On the other hand, compliance with standards recorded a GSI of 0.70, placing it in the "satisfied" category and within the range of "more satisfied than dissatisfied" (see Table 5). This result indicates a favorable perception regarding compliance policies, although it may suggest the need for improvements in training and clarity in communicating standards to increase overall employee compliance.

Table 5: Calculating the GSI of the compliance dimension (S_3). Source: Own elaboration.

Linguistic term	SVNN	Punctuation (w_j)	Frequency (L_p^r)	$W_j \cdot L_p^r$	$\frac{W_j \cdot L_p^r}{n}$
Clearly satisfied (CS)	(1,0,0)	1.00	21	21	0.47
More satisfied than dissatisfied (MSD)	(0.75,0.35,0.3)	0.90	15	10.5	0.23
Undefined (U)	I	0.50	4	2	0.04
More dissatisfied than satisfied (MDS)	(0.35,0.85,0.7)	-0.10	3	-0.9	-0.02
Clearly dissatisfied (CD)	(0,1,1)	-1.00	1	-1	-0.02
Contradictory (C)	(1,0,1)	0.00	1	0	0.00
Group Satisfaction Index					0.70

Finally, soft skills received the lowest GSI, 0.64, placing it in the "satisfied" category but close to the "moderately satisfied (MDS)" range (see Table 6). This result suggests that while employees value the development of soft skills, this dimension requires attention to achieve greater alignment with the company's strategic objectives and improve satisfaction in this specific aspect.

Table 6: Calculation of the GSI of the soft skills dimension (S_4). Source: Own elaboration.

Linguistic term	SVNN	Punctuation (w_j)	Frequency (L_p^r)	$W_j \cdot L_p^r$	$\frac{W_j \cdot L_p^r}{n}$
Clearly satisfied (CS)	(1,0,0)	1.00	18	18	0.40
More satisfied than dissatisfied (MSD)	(0.75,0.35,0.3)	0.90	17	11.9	0.26
Undefined (U)	I	0.50	2	1	0.02
More dissatisfied than satisfied (MDS)	(0.35,0.85,0.7)	-0.10	1	-0.3	-0.01
Clearly dissatisfied (CD)	(0,1,1)	-1.00	2	-2	-0.04
Contradictory (C)	(1,0,1)	0.00	5	0	0.00
Group Satisfaction Index					0.64

In addition to the satisfaction levels, the analysis revealed frequencies in the undefined (U) and contradictory (C) response categories. The undefined category (U), with a value of 0.50, represents cases where participants have no clear position, potentially indicating a lack of information or understanding of certain organizational aspects. On the other hand, contradictory responses (C), with a neutral value of 0, reflect opposing or inconsistent opinions, which may suggest varied experiences or tensions in the perception of policies and practices within the organization. This latter category, therefore, shows a greater need for training, which aligns with the results obtained. The four dimensions present a moderately high satisfaction level, where their GSIs indicate differentiated priorities for the organization (see Figure 1).

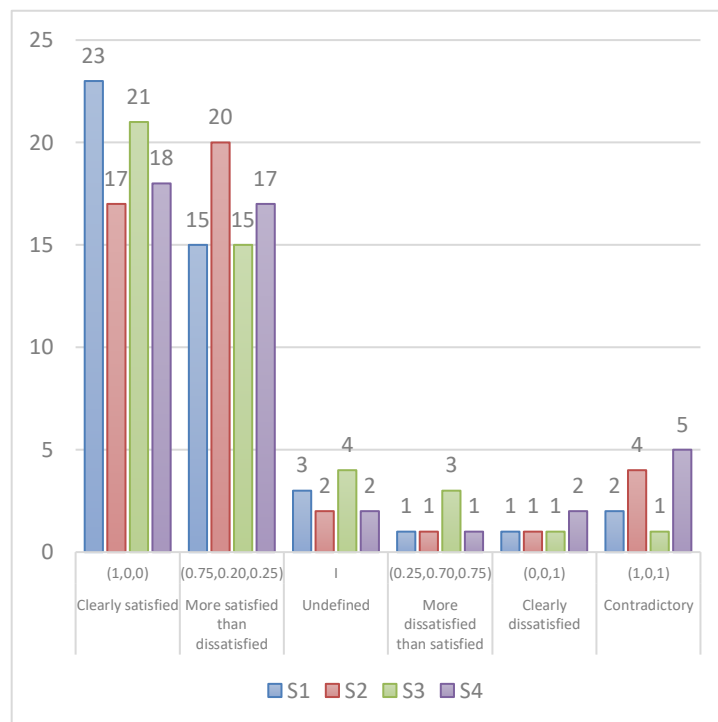


Figure 1: Comprehensive evaluation of S_1, S_2, S_3 and S_4 Dimensions. Source: Own elaboration.

On the other hand, the analysis of the plithogenic areas, based on employees' perceptions of the evaluated dimensions (organizational objectives, elimination of gaps, compliance with standards, and soft skills), reveals a majority distribution of positive opinions. 43.89% of participants are grouped in the "clearly satisfied (CS)" category, while 37.22% position themselves as "more satisfied than dissatisfied (MSD)." This suggests that a significant proportion of employees perceive a positive alignment with the evaluated organizational aspects. However, 6.11% of participants are in the "undefined (U)" category, indicating ambiguity or a lack of clarity about their satisfaction. Meanwhile, 6.67% fall into the "contradictory (C)" area, reflecting opposing perceptions about the studied dimensions.

In contrast, the areas of "more dissatisfied than satisfied (MDS)" and "clearly dissatisfied (CD)" are minimally represented, with 3.33% and 2.78%, respectively, signaling that a small proportion of employees feel dissatisfied or very dissatisfied with the evaluated organizational aspects. In terms of proportion, the "clearly satisfied (CS)" and "more satisfied than dissatisfied (MSD)" areas dominate the analysis, representing more than 80% of the responses, suggesting an acceptable satisfaction level (see Figure 2). However, the "contradictory" and "undefined" areas indicate areas of uncertainty or lack of clarity that require attention. Overall, these results suggest that, although most workers perceive the evaluated dimensions positively, there are sectors that need greater clarity in communication and efforts to address existing dissatisfaction and contradictions within the organization.

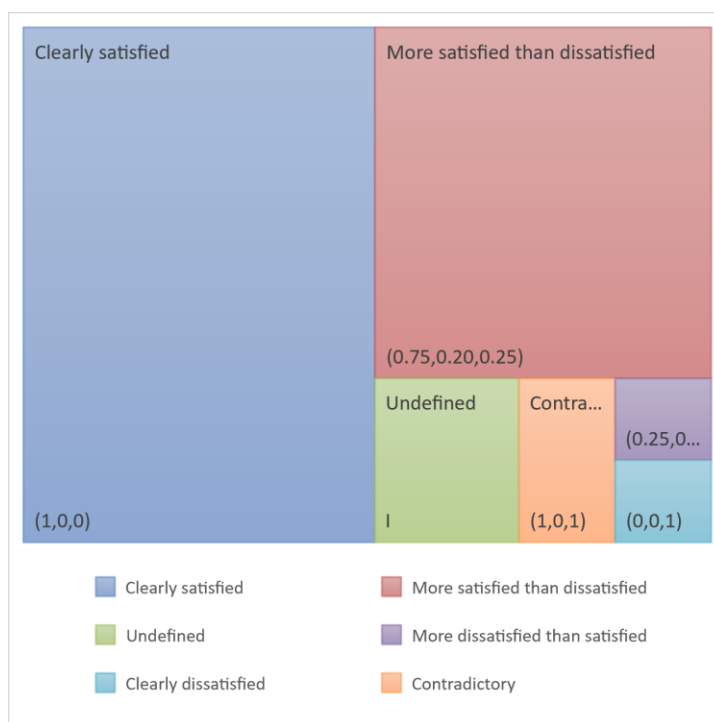


Figure 2: Plithogenic areas within organizational performance and human development. Source: Own elaboration.

Plithogenic Interrelationship: The relationships between the dimensions suggest that they do not operate independently but are closely interconnected. Any variability or change in one dimension impacts the others, reflecting the interdependence within the organizational system. The relationships between the dimensions are moderate, indicating that although each dimension has its specific function, variability in one causes chain effects that affect the behavior of the other dimensions.

Plithogenic Intersections: By segmenting workers into groups with similar perceptions of the evaluated dimensions, the existence of subgroups (arising from the intersection of subsets or dimensions) within the organizational set is reflected. For example, a significant group of employees shows high levels of satisfaction with all dimensions, indicating consistent alignment between workers' perceptions and organizational objectives. On the other hand, a smaller group of employees expresses dissatisfaction with the evaluated dimensions, highlighting the existence of misalignments that require attention to improve integration within the organizational system.

Plithogenic Links: The hierarchical analysis of the dimensions reveals how they cluster based on similarity, indicating varying degrees of interdependence within the organizational set. Generally, some dimensions, such as gap elimination and soft skills, show a high correlation and cluster together, suggesting that they share common and functional dimensions within the organizational structure. In contrast, other dimensions, such as compliance with standards, show a weaker relationship with the others, indicating that this dimension requires more intervention or improvement to strengthen its integration within the system.

The plithogenic analysis of satisfaction dimensions within organizations reveals an interconnected and interdisciplinary system, which must be considered when implementing improvement actions. Even organizations showing high levels of satisfaction in several key areas suggest the need for soft skills training for employees in Cotopaxi, as they demonstrate a positive impact on work performance, productivity, and organizational efficiency. Furthermore, the development of skills such as communication and teamwork is essential to improve adaptability and reduce competence gaps. Additionally, these skills are key to ensuring compliance with standards and aligning with organizational objectives,

by promoting a collaborative and results-oriented environment. They also contribute to employee satisfaction and retention, strengthening organizational stability and overall business success.

4. Conclusion

The results obtained through the analysis conducted with the plithogenic IADOV method have revealed contradictions and indeterminacies in the data regarding training and its impact on organizational competitiveness. While the need for soft skills and employee development training has been acknowledged, a significant portion of the workers has expressed dissatisfaction, particularly concerning compliance with standards. The plithogenic analysis has facilitated the identification of gaps between organizational expectations and the needs perceived by employees. This suggests that the training strategies implemented thus far have not achieved the expected results. Consequently, the study emphasizes the need to redirect training programs towards strengthening soft skills, to reduce existing gaps, optimizing job satisfaction and retention, and thus increasing organizational competitiveness.

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Received: July 05, 2024. Accepted: September 15, 2024