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Quality Management in the Faculty of Business Sciences at the José Faustino Sánchez Carrión National University: A Study Based on the Neutrosophic Linguistic 2-Tuple Model

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Abstract. This research study is the product of a comprehensive, profound, and objective diagnosis of the academic and administrative situation of the Faculty of Administrative Sciences and Tourism of the José Faustino Sánchez Carrión National University in Peru, which has allowed us to examine its management, the degree of efficiency, quality of training of academic schools and the factors that influence the quality of management. Quality in higher education is an important aspect to measure to guarantee the best results for our graduates in their professional lives within society. This paper aims to measure the quality of education in the aforementioned faculty, where the expected outcome is compared with the measured in reality, through a group of interviews. To facilitate assessment, a linguistic scale is used. On the other hand, the use of a triad of truthfulness, indeterminacy, and falseness allows us to deal explicitly with indeterminacy. That is why, for the processing of the collected data, we used the neutrosophic 2-tuple linguistic model.

Keywords: Higher Education Quality, Computing with Words (CWW), Neutrosophic 2-tuple Linguistic Model.

1. Introduction

It is an accepted truth that the development of nations depends primarily on the quality of higher education services that enable their youth to obtain academic and professional training, which will eventually lead them to successfully face the working world. To achieve quality educational services, educational institutions must be managed like modern corporate enterprises.

This point of view has already been raised by renowned Peruvian teachers such as Dr. Otoniel Alvarado Oyarce. Through his work, he expresses innovative thinking on how to manage educational centers using approaches and tools from administrative theories. In one of his works, Dr. Francisco Farro Custodio teaches us how to manage educational centers and universities, challenging some of the many problems facing Peruvian reality. He points out that today, it is no longer disputed that any educational institution truly constitutes a business, and in this sense, any person responsible for leading it must do so based on professional work inherent to the sciences of administration and education. Dr. Nemesio Espinoza Herrera, in his work "University Management," presents a diagnosis that describes the current situation of universities in Peru and shares his perspectives on applying administration through new

management models.

The advancement of administrative science and technology presents us with a new and innovative approach to applying it to the university as a center of higher education, which urgently requires guiding knowledge for efficient management. This knowledge can address the troubling problems that must be resolved to achieve improvement in the pursuit of excellence in the quality of professional training for its students.

It is therefore important to examine the managerial problem of governance and management in order to implement a management model, which will help authorities improve their performance in running these higher education institutions.

To achieve improved productivity and quality of academic services, reflected in the product or output of highly academic, ethical, moral, creative, and innovative professionals who enter the market and are competitive, a necessary condition is the ability to respond to the changes in the external and internal environment that this implies for universities. To this end, it is appropriate to describe the academic and administrative aspects that constitute part of the problems faced by the Faculty of Administrative Sciences and Tourism.

The objective of this paper is to analyze and evaluate the Professional Academic Schools and functional units of the Faculty of Administrative Sciences and Tourism of the José Faustino Sánchez Carrión National University in Huacho, Peru, based on its mission and objectives, with the aim of designing a management model that allows for efficient, effective, and quality management in the long and short term.

There are several quality assessment methods. The SERVQUAL model is a widely used tool for measuring service quality [1, 2]. It is based on the difference between customer expectations and perceptions. It assesses five key dimensions:

- 1. Reliability: The company's ability to deliver on its promises accurately.
- 2. Responsiveness: Employees' willingness to help and provide prompt service.
- 3. Security: Confidence and knowledge of the staff in providing the service.
- 4. Empathy: Personalized attention and understanding of the client's needs.
- 5. Tangible elements: Physical aspects such as facilities, equipment, and staff appearance.

Other similar methods include:

- SERVPERF Model [3]: Focuses only on the perception of service without considering prior expectations.
- QFD (Quality Function Deployment) [4]: Translates customer needs into specific quality requirements.
- ISO 9001 [5]: Uses measurement and monitoring to ensure evidence-based decisions.
- Quality indicators: Tools such as customer satisfaction, operational efficiency, and compliance with standards.

From these methods we will take the idea of comparing perception of reality with what is expected, to determine quality as the difference between these two evaluations.

For evaluations, we prefer to use linguistic value scales because this is the natural way humans evaluate. Thus, we rely on the 2-tuple model [6, 7]. The 2-tuple model is a technique used in decision-making based on linguistic information. It is used to manage uncertainty and ambiguity in evaluations expressed in words rather than numbers. This method allows linguistic terms to be transformed into numerical values without losing the original semantics, facilitating precise calculations in decision-making systems.

The 2-tuple method is a way to approach Computing with Words (CWW), which is a technique used to process linguistic information in decision-making and computing systems. CWW seeks to represent

and manipulate data expressed in words rather than numbers, which is useful when precise values are difficult to obtain or when working with subjective evaluations. The 2-tuple approach within CWW allows linguistic terms to be transformed into a numerical representation without losing the original semantics [8-13]. This is especially relevant in applications such as decision support systems, artificial intelligence, and evaluating options under uncertainty.

To explicitly take into account indeterminacies, the neutrosophic 2-tuple linguistic model emerged, which is an extension of the 2-tuple method that incorporates neutrosophic logic, which considers not only truth and falsity but also indeterminacy [14-21]. This is useful in situations where information is imprecise or incomplete, allowing for a more flexible and realistic representation of uncertainty in decision-making. One example of another paper that uses Neutrosophy or Plithogeny in the study of pedagogical sciences can be read at [22].

In this article we apply the neutrosophic 2-tuple linguistic model to calculate the quality of education provided at the Faculty of Administrative Sciences and Tourism of the José Faustino Sánchez Carrión National University. To do so, we used linguistic scales of truthfulness, indeterminacy, and falseness to compare the results obtained from a set of respondents' opinions with the expectations for each aspect measured.

To achieve our goal, we continue with a section of Preliminaries that contains the basic elements of the theory of the 2-tuple linguistic model and the neutrosophic 2-tuple linguistic model. The Results section contains the details and results of the applied method. The last section is the Conclusion.

2. Preliminaries

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This section recalls the main concepts of the 2-tuple linguistic set and neutrosophic 2-tuple linguistic set theory.

Definition 1 ([14-21]). Given $S = \{s_0, s_1, ..., s_g\}$ is a set of linguistic terms and the number $\beta \in [0, g]$ that is a value representing the outcome of a symbolic operation, then the linguistic 2-tuple expressing the information equivalent to β is achieved with the support of the following function:

$$\Delta: [0,g] \to S \times [-0.5, 0.5)$$

$$\Delta(\beta) = (s_i, \alpha)$$
(1)

Here, s_i is the linguistic term satisfying $i = round(\beta)$ and $\alpha = \beta - i$, $\alpha \in [-0.5, 0.5)$, where *round*(·) is the rounding operator as usual, whereas s_i is the term having the nearest index to β . α is the result of the symbolic translation.

Let us observe that Δ^{-1} : $\langle S \rangle \rightarrow [0,g]$ is taken as $\Delta^{-1}(s_i, \alpha) = i + \alpha$. So, there is a linguistic 2-tuple $\langle S \rangle$ associated with a numerical value in [0,g].

Let $S = \{s_0, ..., s_g\}$ be a 2-*Tuple Linguistic Set* (2TLS) having odd cardinality g+1. Then, we have *L*, and the three numbers a, b, $c \in [0, g]$, satisfying $(s_T, a), (s_I, b), (s_F, c) \in L$, the three of them expressing independently the degree of truthfulness, indeterminacy, and falsehood, respectively by 2TLS. The 2-*tuple Linguistic Neutrosophic Number* (2TLNN) is defined with Equation 2:

$$l_{j} = \left\{ (s_{T_{j}}, a), (s_{I_{j}}, b), (s_{F_{j}}, c) \right\}$$
(2)

Where $0 \le \Delta^{-1}(s_{T_j}, a) \le g$, $0 \le \Delta^{-1}(s_{I_j}, b) \le g$, $0 \le \Delta^{-1}(s_{F_j}, c) \le g$, and $0 \le \Delta^{-1}(s_{T_j}, a) + \Delta^{-1}(s_{I_j}, b) + \Delta^{-1}(s_{F_i}, c) \le 3g$.

We can rank 2TLNNs using the scoring and accuracy functions.

If $l_1 = \{(s_{T_1}, a), (s_{I_1}, b), (s_{F_1}, c)\}$ is a 2TLNN in L, the scoring and accuracy functions in l_1 are defined respectively, below:

$$\begin{split} & \mathcal{S}(l_{1}) = \Delta \left\{ \frac{2g + \Delta^{-1}(s_{T_{1}}, a) - \Delta^{-1}(s_{I_{1}}, b) - \Delta^{-1}(s_{F_{1}}, c)}{3} \right\}, \ \Delta^{-1}(\mathcal{S}(l_{1})) \in [0, g] \end{split} \tag{3} \\ & H(l_{1}) = \Delta \left\{ \frac{g + \Delta^{-1}(s_{T_{1}}, a) - \Delta^{-1}(s_{F_{1}}, c)}{2} \right\}, \ \Delta^{-1}(H(l_{1})) \in [0, g] \end{aligned} \tag{3}$$

3. Results

The target population of this research includes authorities, faculty, students, and alumni of the Faculty of Administrative Sciences and Tourism of the José Faustino Sánchez Carrión National University. 188 of them were interviewed. The following research question is formulated:

Has the Faculty of Administrative Sciences and Tourism established and formulated its mission and objectives, recognizing that it is a community of professors, students, and graduates, whose management is the attribute and responsibility of its members?

To answer the question, respondents are divided into four groups:

- 1. Government Authorities,
- 2. Teachers,
- 3. Students,
- 4. Graduates.

The measurement scale was as follows:

$$S = \{s_0, s_1, s_2, s_3, s_4\}$$
, where $g = 4$, such that:

(s₀, 0): "Strongly disagree", (s₁, 0): "Partially disagree", (s₂, 0): "Neither agree nor disagree", (s₃, 0): "Partially agree", (s₄, 0): "Strongly agree".

The ith respondent is asked to rate $s_{T_{k_{ij}}}$, $s_{F_{k_{ij}}}$, $s_{F_{k_{ij}}}$, for each jth question (j = 1, 2, ..., 11) in the survey on a triple, where k is a value between 0 and 4; while $s_{T_{k_{ij}}}$ is the respondent's assessment of the truth of the proposition, $s_{I_{k_{ij}}}$ is the uncertainty of the respondent's opinion, and $s_{F_{k_{ij}}}$ is the degree of falsity of the proposition according to the respondent. This assessment is taken as the set:

$$l_{ij} = \left\{ (s_{T_{k_{ij}}}, 0), (s_{I_{k_{ij}}}, 0), (s_{F_{k_{ij}}}, 0) \right\}$$

Additionally, it is set (s_3 , 0) as the minimum expected value, or equivalently $\beta = 3$. This is done to ensure that the expected quality is met.

(5)

The propositions that each respondent is asked to confirm or refute are as follows:

Proposi- tion	Has this university established and formulated its mission and objectives, recognizing that it is a community of professors, students, and graduates, and whose management is the attribute and		
	responsibility of its members?		
1	MISSION		
	There is a written mission statement at the institutional and faculty level.		
2	The mission statement includes research strategy, formulation, university outreach, and production		
	of goods and services.		
3	The mission statement is understood by students and graduates of the Faculty.		
4	The mission statement is known by students and graduates of the Faculty.		
5	The mission statement is applied by students and graduates of the Faculty.		

Table 1. Propositions from the survey were applied to the respondents.

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Proposi-	Has this university established and formulated its mission and objectives, recognizing that it is	
tion	a community of professors, students, and graduates, and whose management is the attribute and	
	responsibility of its members?	
6	GOALS	
	The geographic area to which educational services are provided is clearly defined.	
7	The professional courses offered have been specified, and admission quotas have been set.	
8	The objectives of the basic areas of research, training, social outreach, and production of goods and	
	services are explicit and realistic.	
9	The coverage objectives for each school have been indicated and quantified.	
10	The quality objectives of academic and administrative services have been indicated and quantified	
11	There are clear policies regarding student participation in the running of the faculty.	

An important equation is to convert a triad (s_T, a) , (s_I, b) , (s_F, c) into a single value χ_T , where 2TLNN becomes 2TLN. Suppose the indices of (s_T, a) , (s_I, b) , (s_F, c) in S are p, q, and r, respectively. Then the single index is obtained from the formula:

$$\tilde{\beta} = \frac{8+\beta_T - \beta_I - \beta_F}{3}$$
(6)
Where,
$$\beta_T = p + a,$$

$$\beta_I = q + b,$$

$$\beta_F = r + c.$$
Note that $\beta_T, \beta_I, \beta_F \in [0, 4].$

On the other hand, the maximum of $\tilde{\beta}$ is obtained for the combination $\beta_T = 4$, $\beta_I = 0$, $\beta_F = 0$, and therefore $\tilde{\beta} \leq 4$; and the minimum is obtained for the combination $\beta_T = 0$, $\beta_I = 4$, $\beta_F = 4$ and therefore $0 \leq \tilde{\beta}$.

This function is the score function in Equation 3.

This value is then calculated as $\Delta(\tilde{\beta})$ to be the 2-tuple (s_i, α) of Equation 1.

The procedure we will follow in processing the survey data is as follows:

- 1. Each respondent evaluates the survey propositions shown in Table 1 according to three linguistic values of S, resulting in a set of values $l_{ij} = \{(s_{T_{k_{ij}}}, 0), (s_{I_{k_{ij}}}, 0), (s_{F_{k_{ij}}}, 0)\}$. Where *i* is the respondent index and *j* is the question index.
- The average is calculated for each group of respondents (local government members, teachers, students, and graduates) and all respondents in general. The following equation is used:

$$\bar{l}_{G_{m}j} = \left\{ (s_{T_{G_{m}\overline{k_{l}}}}, a), (s_{IG_{m\overline{k_{l}}}}, b), (s_{F_{G_{m}\overline{k_{l}}}}, c) \right\}$$
(7)

Such that m = 1, 2, 3, 4, 5;

- G_1 is the group of respondents from the local government,
- G_2 is the group of teachers surveyed,
- G_3 is the group of student respondents,
- G_4 is the group of respondents who graduated,

 G_5 is the group of all respondents.

The average over a G_m for $(s_{T_{k_{ij}}}, 0), (s_{I_{k_{ij}}}, 0)$ is obtained from the average of the indices $T_{k_{ij}}$, $I_{k_{ij}}, F_{k_{ij}}$ for all *i* belonging to G_m . From now on, we obtain betas for each triple of each question, and finally by applying Equation 1 we obtain the 2TLNNs of Equation 7.

3. Each of the 2TLNNs in Equation 7 becomes a single 2TLN for each group G_m and for each proposition in the survey j = 1, 2, ..., 11.

In this way, we have the following betas of the 2TLNs:

 $\hat{\beta}_{G_m j}$ which is the beta obtained for the group G_m , m = 1, 2, 3, 4, 5 concerning the j-th question.

4. In this way, for each group and each question, the result is returned:

 $\Delta(\hat{\beta}_{G_{\mathrm{m}}j}) = (s_{\theta_{j}}, \hat{\alpha}_{G_{\mathrm{m}}j}),$

Where $\theta_j \in \{0, 1, 2, 3, 4\}$ and $\hat{\alpha}_{G_m j} \in [-0.5, 0.5)$.

Besides:

Whether $\hat{\beta}_{G_{m}j} < 3$, then the aspect measured in the j-th question does not satisfy the minimum expected quality.

Whether $\hat{\beta}_{G_m j} \ge 3$, then the aspect measured in the j-th question satisfies the minimum expected quality.

The results are summarized in Tables 2-6.

Proposi- tion	Linguistic Average	2TLN equivalent	Does it satisfy quality?
1	$(s_1, -0.5), (s_0, 0.333), (s_0, 0.333)$	(<i>s</i> ₃ , -0.389)	No
2	$(s_1, -0.5), (s_1, -0.333), (s_0, 0.167)$	(<i>s</i> ₃ , -0.444)	No
3	$(s_0, 0), (s_0, 0.333), (s_1, -0.5)$	(<i>s</i> ₂ , 0.389)	No
4	$(s_0, 0), (s_0, 0.333), (s_1, -0.5)$	(<i>s</i> ₂ , 0.389)	No
5	$(s_0, 0), (s_1, -0.333), (s_0, 0.333)$	(<i>s</i> ₂ , 0.333)	No
6	$(s_1, -0.5), (s_0, 0.333), (s_1, -0.5)$	(<i>s</i> ₃ , -0.444)	No
7	$(s_0, 0), (s_1, -0.333), (s_0, 0.333)$	(<i>s</i> ₂ , 0.333)	No
8	$(s_1, -0.5), (s_0, 0.333), (s_0, 0.333)$	(<i>s</i> ₃ , -0.389)	No
9	$(s_0, 0), (s_0, 0.333), (s_1, -0.333)$	(<i>s</i> ₂ , 0.333)	No
10	$(s_1, -0.5), (s_1, -0.333), (s_0, 0.333)$	(<i>s</i> ₃ , -0.5)	No
11	$(s_0, 0), (s_0, 0.333), (s_1, -0.5)$	(<i>s</i> ₂ , 0.389)	No

Table 2. The result of the opinion of the government authorities in the form of 2TLNNs, its equivalent in the form of 2TLNs, and the decision.

Proposi- tion	Linguistic Average	2TLN equivalent	Does it satisfy quality?
1	$(s_0, 0.107), (s_1, -0.286), (s_0, 0.357)$	(<i>s</i> ₂ , 0.345)	No
2	$(s_0, 0.25), (s_1, -0.143), (s_0, 0.143)$	(<i>s</i> ₂ , 0.417)	No
3	$(s_0, 0.107), (s_1, -0.214), (s_0, 0.357)$	(<i>s</i> ₂ , 0.321)	No
4	$(s_0, 0.107), (s_1, -0.286), (s_0, 0.429)$	(<i>s</i> ₂ , 0.321)	No
5	$(s_0, 0.25), (s_1, -0.143), (s_0, 0.286)$	(<i>s</i> ₂ , 0.369)	No
6	$(s_0, 0), (s_1, -0.143), (s_0, 0.357)$	(<i>s</i> ₂ , 0.262)	No
7	$(s_0, 0.107), (s_0, 0.286), (s_1, -0.357)$	(<i>s</i> ₂ , 0.393)	No
8	$(s_0, 0), (s_0, -0.143), (s_0, 0.357)$	(<i>s</i> ₂ , 0.262)	No
9	$(s_0, 0), (s_0, -0.214), (s_0, 0.393)$	(<i>s</i> ₂ , 0.274)	No
10	$(s_0, 0.107), (s_0, -0.214), (s_0, 0.393)$	(<i>s</i> ₂ , 0.310)	No
11	$(s_0, 0.214), (s_0, -0.214), (s_0, 0.464)$	(<i>s</i> ₂ , 0.321)	No

Table 3. The result of the teachers	opinion in the form of 2TLNNs, its eq	uivalent in the form of 2TLNs and the decision.
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Table 4. The result of the student's opinion in the form of 2TLNNs, its equivalent in the form of 2TLNs and the decision
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Proposi- tion	Linguistic Average	2TLN equivalent	Does it satisfy quality?
1	$(s_0, 0.396), (s_1, -0.319), (s_0, 0)$	(<i>s</i> ₃ , -0.429)	No
2	$(s_0, 0.363), (s_1, -0.495), (s_0, 0)$	(<i>s</i> ₃ , -0.381)	No
3	$(s_0, 0), (s_1, -0.363), (s_0, 0.041)$	(<i>s</i> ₂ ,0.40)	No
4	$(s_0, 0), (s_1, -0.298), (s_0, 0.066)$	(<i>s</i> ₂ , 0.410)	No
5	$(s_0, 0), (s_1, -0.319), (s_0, 0.055)$	(<i>s</i> ₂ , 0.421)	No
6	$(s_0, 0), (s_1, -0.473), (s_0, 0.077)$	(<i>s</i> ₂ , 0.465)	No
7	$(s_0, 0.132), (s_1, -0.451), (s_0, 0.055)$	(<i>s</i> ₃ , -0.491)	No
8	$(s_0, 0.165), (s_0, -0.495), (s_0, 0.077)$	(<i>s</i> ₃ , -0.473)	No
9	$(s_0, 0.231), (s_0, 0.484), (s_0, 0.055)$	(s ₃ , -0.436)	No

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Proposi- tion	Linguistic Average	2TLN equivalent	Does it satisfy quality?
10	$(s_0, 0.198), (s_1, -0.495), (s_0, 0.077)$	(<i>s</i> ₃ , -0.462)	No
11	$(s_0, 0), (s_0, -0.429), (s_0, 0.110)$	(<i>s</i> ₂ , 0.440)	No

Proposi- tion	Linguistic Average	2TLN equivalent	Does it satisfy quality?
1	(<i>s</i> ₀ , 0.190), (<i>s</i> ₀ , 0.476), (<i>s</i> ₀ , 0.365)	(s ₂ , -0.450)	No
2	$(s_0, 0.365), (s_1, -0.206), (s_0, 0.175)$	(<i>s</i> ₂ , 0.466)	No
3	$(s_0, 0.238), (s_1, 0.143), (s_0, 0)$	(<i>s</i> ₂ ,0.365)	No
4	$(s_0, 0.286), (s_1, 0.111), (s_0, 0)$	(<i>s</i> ₂ , 0.392)	No
5	$(s_0, 0.238), (s_1, -0.079), (s_0, 0.095)$	(<i>s</i> ₂ , 0.407)	No
6	$(s_0, 0.397), (s_1, -0.048), (s_0, 0.190)$	(<i>s</i> ₂ , 0.418)	No
7	$(s_0, 0.190), (s_1, -0.333), (s_0, 0.270)$	(<i>s</i> ₂ , 0.418)	No
8	$(s_0, 0.238), (s_0, -0.270), (s_0, 0.429)$	(<i>s</i> ₂ , 0.360)	No
9	$(s_0, 0.333), (s_0, -0.239), (s_0, 0.175)$	(<i>s</i> ₂ , 0.466)	No
10	$(s_0, 0.333), (s_1, -0.365), (s_0, 0.206)$	(<i>s</i> ₃ , 0.497)	No
11	$(s_0, 0), (s_0, -0.429), (s_0, 0.317)$	(<i>s</i> ₂ , 0.370)	No

Table 5. Result of the graduates' opinion in the form of 2TLNNs, its equivalent in the form of 2TLNs and the decision.

Proposition	Linguistic Average	2TLN equivalent	Does it satisfy qua- lity?
1	$(s_0, 0.287), (s_1, -0.394), (s_0, 0.186)$	(<i>s</i> ₂ , 0.498)	No
2	$(s_0, 0.351), (s_1, -0.340), (s_0, 0.085)$	(<i>s</i> ₃ , -0.465)	No
3	$(s_0, 0.096), (s_1, -0.181), (s_0, 0.090)$	(<i>s</i> ₂ , 0.395)	No
4	$(s_0, 0.112), (s_1, -0.170), (s_0, 0.112)$	(<i>s</i> ₂ , 0.390)	No
5	$(s_0, 0.117), (s_1, -0.213), (s_0, 0.112)$	(<i>s</i> ₂ , 0.406)	No
6	$(s_0, 0.149), (s_1, -0.287), (s_0, 0.170)$	(<i>s</i> ₂ , 0.422)	No

Proposition	Linguistic Average	2TLN equivalent	Does it satisfy qua- lity?
7	$(s_0, 0.144), (s_1, -0.447), (s_0, 0.223)$	(<i>s</i> ₂ , 0.456)	No
8	$(s_0, 0.176), (s_1, -0.372), (s_0, 0.245)$	(<i>s</i> ₂ , 0.434)	No
9	$(s_0, 0.223), (s_1, -0.383), (s_0, 0.165)$	(<i>s</i> ₂ , 0.480)	No
10	$(s_0, 0.239), (s_1, -0.404), (s_0, 0.176)$	(<i>s</i> ₂ , 0.489)	No
11	$(s_0, 0.032), (s_1, -0.404), (s_0, 0.245)$	(<i>s</i> ₂ , 0.397)	No

As can be seen from Tables 2-6, the expected quality was not achieved in any aspect.

4. Conclusion

There is undoubtedly an abundant literature on university management, strategic planning, quality, and evaluation, which has reached a significant level of development. In the specific field of universities, we have recently observed a notable concern for improving the management of higher education in Latin America and the Caribbean, as expressed by UNESCO specialists. In Peru, there has also been a profound interest among faculty members concerned with improving the quality of higher education through strategic management. Therefore, this article is dedicated to studying the quality of teaching at the Faculty of Administrative Sciences and Tourism of the José Faustino Sánchez Carrión National University. A survey was conducted among 118 members of the city of Huacho, including local government authorities, faculty members, students, and university alumni. The survey determined whether the faculty is aware of and fulfills the mission and objectives proposed at the founding of this educational institution. To this end, 11 questions were formulated, and it was determined that in no case was the minimum quality requirement achieved. For the answers, respondents were asked to respond in the form of 2-tuple Linguistic Neutrosophic Numbers. In this way, uncertainty is taken into account when evaluating the survey questions, and respondents were able to easily use a linguistic scale. When comparing the average results with a pre-established minimum threshold, the scores were below the threshold in all cases. This implies that efforts must be made to improve the quality of this faculty, with the support of the local government, faculty, students, and to the extent possible, alumni.

References

- [1] AlOmari, F. (2021). Measuring gaps in healthcare quality using SERVQUAL model: challenges and opportunities in developing countries. Measuring Business Excellence, 25, 407-420.
- [2] Kavus, B. Y., Tas, P. G., Ayyildiz, E., and Taskin, A. (2022). A three-level framework to evaluate airline service quality based on interval valued neutrosophic AHP considering the new dimensions. Journal of air transport management, 99, 102179.
- [3] Sohail, M. S., and Hasan, M. (2021). Students' perceptions of service quality in Saudi universities: the SERVPERF model. Learning and Teaching in Higher Education: Gulf Perspectives, 17, 54-66.
- [4] Bossert, J. L. (2021). Quality function deployment: The practitioner's approach. CRC Press.
- [5] Fonseca, L. M., Cardoso, M. C., and Nóvoa, M. H. (2022). Motivations for ISO 9001 quality management system implementation and certification–mapping the territory with a novel classification proposal. International Journal of Quality and Service Sciences, 14, 18-36.
- [6] Marti, L., and Herrera, F. (2012). An overview on the 2-tuple linguistic model for computing with words in decision making: Extensions, applications and challenges. Information Sciences, 207, 1-18.

- [7] Martínez, L., Rodriguez, R. M., Herrera, F., Martínez, L., Rodriguez, R. M., and Herrera, F. (2015). 2-tuple linguistic model (pp. 23-42). Springer International Publishing.
- [8] Qin, Y., Liu, Y., Abdullah, S., and Wei, G. (2021). Group decision support methodology based upon the multigranular generalized orthopair 2-tuple linguistic information model. International Journal of Intelligent Systems, 36, 3367-3400.
- [9] Faizi, S., Sałabun, W., Nawaz, S., ur Rehman, A., and Wątróbski, J. (2021). Best-Worst method and Hamacher aggregation operations for intuitionistic 2-tuple linguistic sets. Expert Systems with Applications, 181, 115088.
- [10] González, J. A. T., Velazco, A. E., Lantigua, M. E., and Álvarez, C. A. S. (2021, October). Evaluation of an accreditation variable for university institutions using 2 tuple linguistic representation model. In Conferencia Cientifica Internacional Uciencia (pp. 277-289). Cham: Springer International Publishing.
- [11] Uztürk, D., and Büyüközkan, G. (2022). 2-tuple linguistic model-based circular maturity assessment methodology: a case for agriculture. IFAC-PapersOnLine, 55, 2036-2041.
- [12] Gao, F., Liu, W., Mu, X., Bi, W., and Zhang, A. (2023). Dependence assessment in human reliability analysis using the 2-tuple linguistic information and DEMATEL method. Process Safety and Environmental Protection, 173, 191-201.
- [13] Zhang, Z., Zhang, Z., Dai, S., Zhang, Y., and Chen, X. (2023). A large group hesitant 2-tuple linguistic decision-making trial and evaluation laboratory (DEMATEL) method to evaluate performance indicators. Information Sciences, 647, 119408.
- [14] Ricardo, J. E., Fernández, A. J., & Vázquez, M. Y. (2022). Compensatory Fuzzy Logic with Single Valued Neutrosophic Numbers in the Analysis of University Strategic Management. International Journal of Neutrosophic Science (IJNS), 18(4).
- [15] Wei, G., Wu, J., Guo, Y., Wang, J., and Wei, C. (2021). An extended COPRAS model for multiple attribute group decision making based on single-valued neutrosophic 2-tuple linguistic environment. Technological and Economic Development of Economy, 27, 353-368.
- [16] Lin, J., Yu, R., and Xu, X. (2023). Grey relational analysis method for building material suppliers selection based on the 2-tuple linguistic neutrosophic number. Journal of Intelligent & Fuzzy Systems, 44, 4185-4196.
- [17] Alqaysi, M. E., Albahri, A. S., and Hamid, R. A. (2024). Evaluation and benchmarking of hybrid machine learning models for autism spectrum disorder diagnosis using a 2-tuple linguistic neutrosophic fuzzy sets-based decision-making model. Neural Computing and Applications, 36, 18161-18200.
- [18] Oporto, P. S. V., Morán, N. E. M. P., Hancco, S. M. M., and Chan, A. L. (2024). Integration of NeutroAlgebra and Neutrosophic 2-Tuple Linguistic Likert Scales for Feasibility Assessment in Industrial Projects. Neutrosophic Sets and Systems, 71, 67-74.
- [19] Gómez-Rodríguez, V. G., Avello-Martínez, R., Gajderowicz, T., Álvarez, N. B. D., Jara, J. I. E., Batista Hernández, N., García-Hevia, S., and Salvador, D. D. I. (2024). Assessment of three strategies for teaching an AI liter acy program, based on a neutrosophic 2-tuple linguistic model hybridized with the ARAS method. Neutrosophic Sets and Systems, 70, 378-389.
- [20] Tang, M., and Sun, Y. (2025). Comprehensive Analysis Using 2-tuple Linguistic Neutrosophic MADM with Core Competencies Evaluation of Track and Field Students in Sports Colleges. Neutrosophic Sets and Systems, 77, 331-354.
- [21] Lu, M. (2025). Advancements in MADM with college English teaching quality evaluation: Integrating 2-tuple linguistic neutrosophic models with prioritized heronian mean techniques. International Journal of Knowledge-Based and Intelligent Engineering Systems, 29, 79-94.

[22] Batista-Hernández, N., Leyva-Vázquez, M. Y., González-Caballero, E., Valencia-Cruzaty, L. E., Ortega-Chávez, W., and Smarandache, F. (2021). A new method to assess entrepreneurship competence in university students using based on plithogenic numbers and SWOT analysis. International Journal of Fuzzy Logic and Intelligent Systems, 21, 280-292.

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