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Multicriteria Evaluation of Labor Stability

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Abstract: The job stability of workers represents an indicator for people's quality of life. Evaluating job stability from a legal point of view would allow quantifying its impact on workers from a legal perspective. The present investigation proposes a method for the legal evaluation of the labor stability of the workers. It bases its operation on the Neutrosophic Multi-criteria Linear Weighting method. A Case study is developed on three Cantons of Los Rios province to demonstrate the applicability of the proposed method. Paper ends with conclusion, recommendation and the projections for future works.

Keywords: Legal evaluation; job stability; Neutrosophic Multi-criteria Linear Weighting method.

1. Introduction

Job stability is an important element in the quality of life indicators of society [1, 2]. Workers are supported by legal norms that guarantee their rights [3, 4]. In Ecuador, great importance is attributed to monitoring the job stability indicator [5].

Integrally in Latin America the labor stability of the workers is stipulated in the Constitution of each Country. International Standards such as the International Labor Organization and the Universal Declaration of Human Rights give great importance to the compliance with this indicator [6, 7].

Job stability may vary according to the job code of each country to investigate. Mini contracts, zero hour contracts, informal jobs, although the names vary there are a coincidence in reality or formality which is also known as suitable employment.

The current Constitution of the Republic of Ecuador guarantees people the right to work is a source of personal fulfillment and the basis of the manifest family economy [8, 9]. However, job stability is an issue that has not been properly addressed. The objective of this research is to develop a method for the legal evaluation of the job stability of workers.

This paper proposes a model to evaluate the job stability from a legal point of view. For this purpose, a Neutrosophic Multi-criteria Linear Weighting operator is used. The advantage to incorporate neutrosophic logic is that indeterminacy can be included independently of truth or false values.

This paper has the following structure: Section 2, dedicated to recall the preliminary concept of Job Stability that will be used in this paper. In section 3, we introduce the method for the legal evaluation of job stability. Section 4 shows the implementation of the method to evaluate the situation in three cantons of “Los Rios” province. The paper ends with the conclusions.

2. Preliminaries

With the aim to introduce the main theoretical references on the object of study, the diverse concepts that facilitate the understanding of the research are presented. A description of job stability and its main legal norms is also made:

The principle of *Job Stability* is the right granted by the law to workers to remain in their jobs until there is justifiable cause to terminate their contract [10]. Job stability should be understood as the shared responsibility held by both the employer and the employee or candidate to ensure their effective participation in the work environment while both parties guarantee the addition of value to the processes, products or services that they generate or offer. That is why when achieving this level of satisfaction, the individual can have a better life condition because he/she would be able to meet many requirements and then he/she would go on to scale others that allow him/her to continue growing until he/she exceeds himself/herself. Stability consists of the right of a worker to keep his/her job indefinitely, without incurring in any fault [11].

3. Structure of the method for the legal evaluation of job stability

The present investigation is modeled through a decision-making process where the objects or decisions are considered as a multicriteria decision-making problem [12, 13]. Multicriteria evaluation constitutes an optimization with several simultaneous objective functions and a decision-making agent. Equation 1 formalizes the posed problem.

$$\text{Max} \;\; F(x), x \;\; \in X \tag{1}$$

Where:

x: is a vector $[x_1, \cdots, x_n]$ of the decision variables.

X: it is the so-called feasible region. It represents the possible value domain that the variable can take.

F(x): is a vector $[F_1(x), \cdots, F_n(x)]$ of the objective functions that collect the criteria.

Specifically, discrete multicriteria problems basically consist of two types of data that constitute the starting point for different discrete multicriteria decision-making problems (DMCDM). Figure 1 shows a representation of a multi-criteria method.

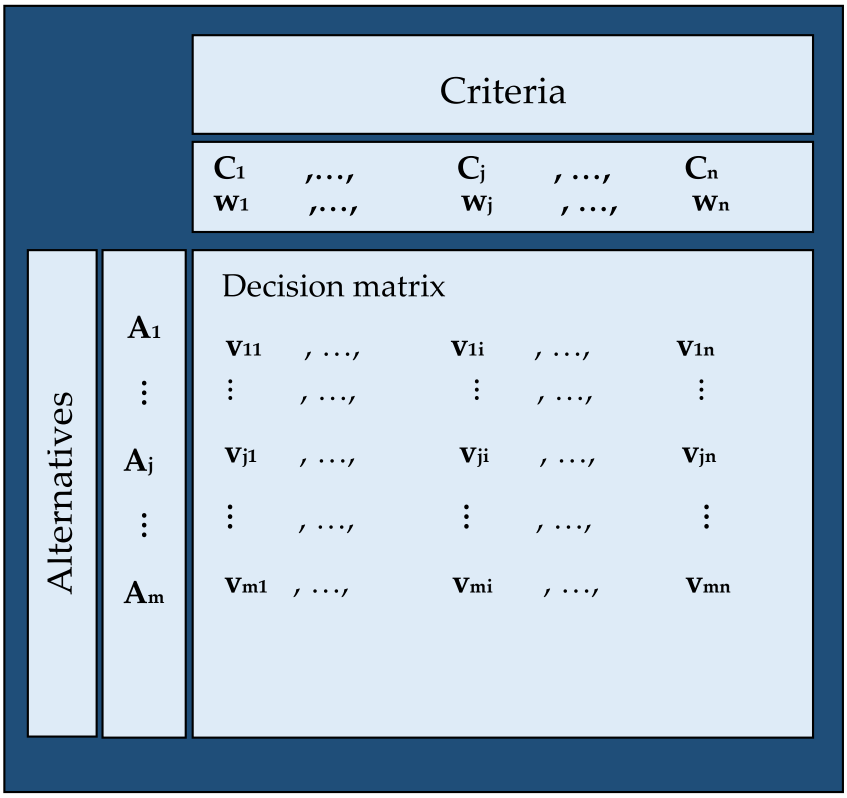

Figure 1. Representation of multi-criteria method.

Figure 1 shows a representation of a multi-criteria decision-making problem where:

r_{ij}: represents the evaluation of the alternative i regarding the criterion j.

w_i: represents the weight of the criterion.

The inference process of the proposed method is based on a multicriteria approach. A weight for the alternative under analysis will be determined. Representing an ordering and aggregation methods [14-16].

The inference can be described mathematically from the linear weighting method. The method consist of calculating an overall score r_i for each alternative A_i as expressed in Equation 2, [17, 18].

$$R_i = \sum_j W_j r_{ij} \quad (2)$$

With the use of the linear weighting, a compensatory process is carried out. The process previously applies the standardization of its criteria. The evaluation problem in question represents a case where [19-21]:

Given a set of *m* alternatives and *n* criteria.

For each j-th criterion the decision maker estimates for each i-th alternative.

Assessment a_{ij} is obtained from the decision matrix that has a cardinal ratio weight. Weight $W_j (j = 1, \cdots, n)$ is assigned also to the cardinal ratio type for each of the criteria C_j.

In the context of multicriteria methods, neutrosophic numbers are introduced in order to represent indeterminacy [22][23]. It constitutes the basis of mathematical theories that generalize classical and fuzzy theories such as neutrosophic sets and neutrosophic logic. [24]. A neutrosophic number (N) is represented as follows [25] [26]:

$N = \{(T, I, F) : T, I, F \subseteq [0,1]\}$, a neutrosophic valuation is a mapping of a group of formulas into N, that is, for each sentence p we have:

$$v\ (p) = (T, I, F) \quad (3)$$

Where: T is the dimension of the space that represents truthfulness, I represents indeterminacy, and F represents falseness, as it is expressed in the Equation 4.

$$R_{i(T,I,F)} = \sum_j W_{j(T,I,F)}\, r_{ij(T,I,F)} \quad (4)$$

A Neutrosophic Linear Weighting method can be mathematically defined as a 3-tuple (R,W, r)

Where:

$R_{i(T,I,F)}$: represents the aggregated function that refers to a dimension of space true, indeterminate, and false (T, I, F).

$W_{j(T,I,F)}$: represents the weight of the criterion associated with the criteria referred to the dimension of the space truth, indeterminacy, and falsehood (T, I, F).

r_{ij}: represents the evaluation of the i-th alternative regarding j-th criterion that refers to a dimension of space truth, indeterminacy, and falsehood (T, I, F).

The proposed method is designed to support the process to evaluate job stability indicators. Figure 2 shows a diagram illustrating this operation.

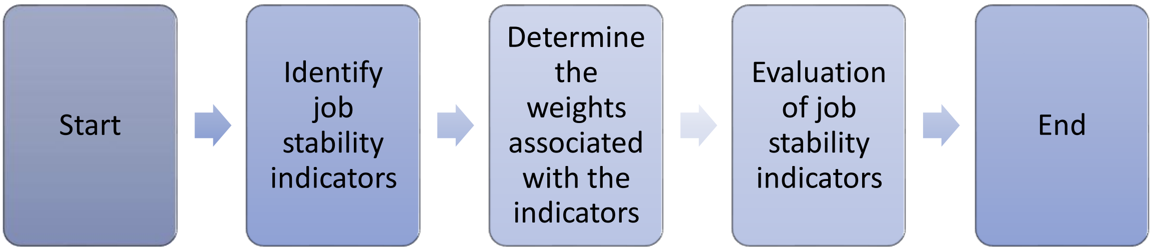

Figure 2. Structure of the proposed method.

The method is designed through a three-stage structure that together determine the legal evaluation of the job stability of the workers.

Stage 1: Identification of job stability criteria.

It represents the set of criteria that are used to quantify the evaluation for the different alternatives. It constitutes a multi-criteria approach formalized as:

$C = \{c_1, \dots, c_n\}$, $n \geq 2$, the evaluation criteria.

Stage 2: Determination of the weights.

To determine the weights associated with the evaluation criteria. A work group approach is used so that:

$E = \{e_1, \dots e_m\}$, $m \geq 2$, where E represents the experts involved in the process. It represents a way to evaluate the weight vectors associated with the evaluation indicators.

Stage 3: Evaluation of job stability.

The evaluation stage represents the processing of the method to output the result of the proposed inference. Data are processed using the linear weighting method in Equation 4. As a result, it expresses the attribute value of job stability. The final evaluation is carried out using a score function [27].

4. Implementation of the juridical method for evaluating labor stability

For the implementation of the proposed method, a study was carried out for the evolution of job stability in different regions of the country. Three cantons (Babahoyo, Baba, Quevedo) were taken as reference. The case study was designed to carry out a legal evaluation of the behavior of the job stability indicators of the selected cantons.

Stage 1: Identification of job stability criteria.

For the analysis and operation of the proposed method, 6 evaluation indicators were used as shown in Table 1.

Index	Job stability criteria
1	Individuals have jobs every month of the year.
2	Individuals have jobs every week.
3	Individuals get paid vacations.
4	He/she gets food from his work.
5	He/she obtains a decent residence from his work.

Table 1. Job stability criteria.

Stage 2: Determination of the weights.

For the stage of determining the weights attributed to the job stability criteria, a group consultation was conducted with 5 experts who expressed their assessments of the stability criteria [28-30]. The process obtained the weight vectors corresponding to the job stability criteria. Vectors obtained from the 5 experts were aggregated using the mean of their results. Table 2 shows the result of the evaluation criteria once the aggregation process has been carried out.

Criteria	Vector $\widetilde{W}$
C_1	[0.92,0.10,0.25]
C_2	[0.90,0.05,0.10]
C_3	[0.5,0.05,0.15]
C_4	[0.85,0.15,0.00]
C_5	[0.72,0.18,0.10]

Table 2. Weight attributed to stability criteria.

Stage 3: Evaluation of job stability.

Based on the behavior of the weights attributed to the evaluation criteria, a diagnostic process of the indicators is carried out in the 3 cantons selected as the object of study. The method assumes that the desired utility function is an additive model that is presented in the form [31][32]:

$$v = w_1 * x_1 + w_2 * x_2 \ + \cdots + w_n * x_n \qquad (5)$$

Where:

w_i: is the weight of the i-th criteria and it is the value of the alternative against the i-th criterion.

w_i are obtained from $\widetilde{w}_i$, where every $\widetilde{w}_i$is converted into a crisp value using Equation 6, and later they are normalized, as in Equation 7.

$$\widehat{w}_i = \frac{1}{3}\left(2 + \mathrm{T}_{\widetilde{w}_i} - \mathrm{I}_{\widetilde{w}_i} - \mathrm{F}_{\widetilde{w}_i}\right) \qquad (6)$$

$$w_i = \frac{\widehat{w}_i}{\sum_{i=1}^{n} \widehat{w}_i} \qquad (7)$$

Then, $W = (w_1, \cdots, w_n)$. Thus, in formula 5 the operators * and + are the usual scalar multiplication of a vector and the vector sum, respectively.

With the weighted average value obtained by the utility function for each alternative, they are sorted [33, 34]. This order solves the decision-making problem and determines the best alternative among the possible ones, which will be the weighted sum [35, 36].

Table 3, 4 and 5 shows the result of the processing carried out for each of the cantons under study.

Criteria	**Vector *W***	**Preferences in Babahoyo**	**Result**	**Crisp value (Score)**
C_1	0.20141	[0.74,0.10,0.18]	[0.149,0.020,0.036]	0.69755 (4)
C_2	0.21552	[0.64,0.16,0.20]	[0.138,0.034,0.043]	0.68678 (5)
C_3	0.18025	[0.80,0.15,0.05]	[0.144,0.027,0.009]	0.70272 (3)
C_4	0.21160	[0.90,0.10,0.10]	[0.190,0.0211,0.021]	0.71604 (2)
C_5	0.19122	[0.90,0.05,0.05]	[0.172, 0.100, 0.009]	0.71766 (1)
Index			**[0.794,0.112, 0.119]**	**0.85433**

Table 3. Processing preferences for Babahoyo.

Criteria	**Vector *W***	**Preferences in Baba**	**Result**	**Crisp value (Score)**
C_1	0.20141	[0.54,0.30,0.06]	[0.109,0.060,0.012]	0.67875 (5)
C_2	0.21552	[0.64,0.26,0.10]	[0.138,0.056,0.022]	0.68678 (3)
C_3	0.18025	[0.60,0.20,0.10]	[0.108,0.036,0.018]	0.68469 (4)
C_4	0.21160	[0.75,0.20,0.05]	[0.159,0.042,0.011]	0.70193 (1)
C_5	0.19122	[0.70,0.15,0.15]	[0.134,0.029,0.0287]	0.69216 (2)
Index			**[0.647,0.22,0.091]**	**0.77765**

Table 4. Processing preferences for Baba.

Criteria	**Vector *W***	**Preferences in Quevedo**	**Result**	**Crisp value (Score)**
C_1	0.20141	[0.80,0.10,0.10]	[0.161,0.020,0.0201]	0.70695 (3)
C_2	0.21552	[0.75,0.15,0.10]	[0.162,0.032,0.022]	0.70259 (5)
C_3	0.18025	[0.80,0.20,0.00]	[0.144,0.0361,0.000]	0.70272 (4)
C_4	0.21160	[0.90,0.10,0.00]	[0.190,0.021, 0.000]	0.72309 (1)
C_5	0.19122	[0.90,0.10,0.00]	[0.172,0.019,0.000]	0.71766 (2)
Index			**[0.830, 0.129, 0.042]**	**0.88634**

Table 5. Processing preferences for Quevedo.

Figure 3 shows a comparative graph showing the behavior between the three cantons under study based on the score function.

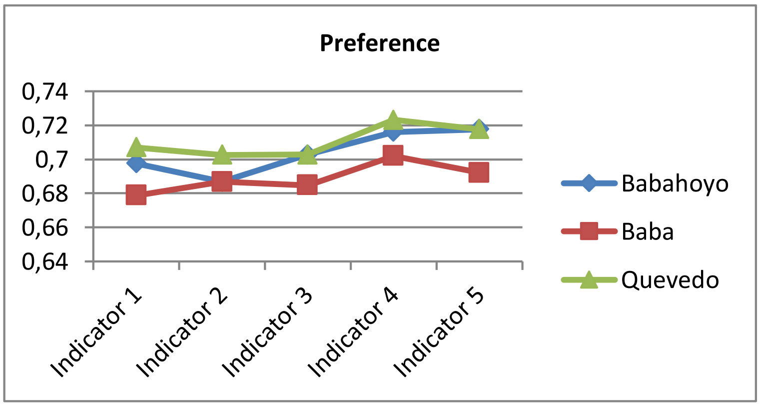

Figure 3. Behavior of preferences between different cantons.

The graph shows the behavior of the three cantons, a similarity in the performance of job stability is evident. However, the canton of Baba has the lowest index of job stability. Quevedo is the one with the best job stability performance and Babahoyo has an intermediate performance compared to the others.

Conclusions

From the development of the proposed research, we obtained a method for the legal evaluation of the job stability of workers. The method bases its operation on neutrosophic linear weighting to model the job stability main indicators.

Through the application of the proposed method, we executed an evaluation of three cantons representing the case studies. The method demonstrated its applicability for legal evaluation of the job stability of workers. The job stability index is determined through its inference process.

Although the proposed case study presents an application of the proposed system, the implementation of other inference engines in the decision-making process is recommended to compare the obtained results.

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