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# Study of the correlation between the behavior of work teams and knowledge management in the offices dependent on the Academic Vice-Rectorate of the National Agrarian University of La Selva: based on Plithogenic Statistics

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**Abstract**. In this paper, we study the statistical relationship between the behavior of work teams and knowledge management in the offices subordinate to the Academic Vice-Rectorate of the Agrarian University of La Selva in Peru. To do so, we use the Plithogenic Statistics tool. We apply this theory to data collected in a survey of 30 members of these offices. We consider that the elements we measure have different origins from the point of view of the disciplines to which they respond. In addition, the data is uncertain and indeterminate. These are the two main reasons for using Plithogenic Statistics. Neutrosophic Statistics generalizes the methods of Classical Statistics when the data or parameters appear in the form of intervals, or when the sample size or population is indeterminate. Plithogenic Statistics generalizes Neutrosophic Statistics when there is indeterminacy, not just in the form of intervals.

**Keywords**: Work behavior, knowledge management, public management, knowledge management processes, Plithogeny, plithogenic statistics, Single-Valued Neutrosophic Number, Plithogenic Neutrosophic Probability.

## 1 Introduction

Management in organizations is influenced by new forces that form the way they operate in order to meet the changing demands of the environment. One of these forces is the power of human resources, since the way people work, think, and behave dictates the direction and success of the organization. Thus, to survive the rapid pace of change, investment in people is necessary.

In the new economy, knowledge replaces capital as a critical resource and consequently, organizations are forced to generate knowledge and design processes that allow its identification, processing, distribution, storage, and maintenance. Now more than ever, consumers expect organizations to be responsive to their needs, to provide them with service and delivery quickly, and to produce high-quality goods and services at the best possible price.

Each organization must respond to the needs of its customers, to legal constraints, and economic and technological changes. To do so, they must adopt different and complementary approaches that help them achieve these objectives. Paying attention to work behavior and managing knowledge turns out to be a key strategy to meet the demands present in an organization. These are approaches that not only private companies know and have been applying, but also public entities through modernization mechanisms.

The relevance of the public entity lies in its purpose, which is to satisfy the basic needs of the population by contributing to its development. Among these, educational entities have the duty to train citizens better prepared to carry out activities that contribute to the progress of the country.

The National Agrarian University of the Jungle (UNAS in Spanish) of Peru, as a higher education institution and as a public entity, has key objectives whose achievement will depend on the management approaches it adopts

in its strategy. With work behavior and knowledge management as key action strategies, it is necessary to know the situation of both approaches to obtain an approximation of the existing gap whose narrowing becomes one of the courses of action to be adopted in the future.

Finally, the study seeks to answer the general problem, defined by the question: Is there a relationship between the behavior of work teams and knowledge management in the offices dependent on the Academic Vice-Rectorate of the National Agrarian University of La Selva?

Each of the two variables to be studied is made up of different sub-elements that belong to different domains. Behavior within work teams and knowledge management can be studied from different perspectives such as work psychology, sociology, and economics. On the other hand, the study contains uncertainty and indeterminacy that is not only random but also cognitive.

That is why, instead of applying a traditional statistical method, we chose to use the Plithogenic Statistics as a study tool [1, 2]. Firstly, the indeterminacy and uncertainty of the data can be studied within Neutrosophic Statistics, where traditional statistical methods are extended to data and parameters in the form of intervals, [3-8]. They can also be applied when the sample or population size is indeterminate. Plithogenic Statistics is even more general and allows the application of statistical methods to data with uncertainty in any form [9].

Plithogeny is the new theory created by F. Smarandache, which attempts to model concepts, ideas, phenomena, etc., in such a way that the dialectic between different elements (concepts, ideas, phenomena, etc.) is generalized, the interaction between them, their opposites and their neutrals, so that it is closer to realistic modeling of the world [10-18].

The paper surveys a group of university members to determine whether there is a relationship between the behavior of work teams and knowledge management in the offices dependent on the Academic Vice-Rectorate of the National Agrarian University of La Selva. The Spearman's Rho coefficient is applied as an indicator of correlation between the two variables, generalized to the Plithogenic theory of Statistics.

The paper is divided into a Materials and Methods section, where the basic elements of Plithogenic Statistics are explained. The details and results of the research are then presented in the next section. Conclusions are given at the end.

## 2 Materials and Methods

The Plithogenic Probability of an event occurring is composed of the probabilities of the event occurring for all the random variables or parameters that constitute it [6, 19]. The Plithogenic Probability based on the Plithogenic Variation Analysis, is multi-dimensional. It could be said that it is a probability of sub-probabilities, where each sub-probability refers to the behavior of a variable by assuming that the event is produced by one or more variables. Each variable is represented by a Probability Distribution (Density) Function (PDF).

According to the classification of F. Smarandache, the subclasses of Plithogenic Probability are as follows:

(1) Classical MultiVariate Probability: If all PDFs are classical.

(2) Plithogenic Neutrosophic Probability is defined when the PDF is expressed in the form of $(\mathrm{T}, \mathrm{I}, \mathrm{F})$, where $T$ is the probability that the event occurs, $I$ is the probability of indeterminacy that the event occurs and $F$ is the probability that the event does not occur. Such that the following is fulfilled: $\mathrm{T}, \mathrm{I}, \mathrm{F} \in [0,1]$, $0 \leq \mathrm{T} + \mathrm{I} + \mathrm{F} \leq 3$.

(3) Plithogenic Indeterminate Probability: When all PDFs have indeterminate data or arguments.

(4) Plithogenic Intuitionistic Fuzzy Probability: When PDFs have the form $(\mathrm{T}, \mathrm{F})$ where $\mathrm{T}, \mathrm{F} \in [0,1]$, $0 \leq \mathrm{T} + \mathrm{F} \leq 1$.

(5) Plithogenic Picture Fuzzy Probability: When PDFs have the form $(\mathrm{T}, \mathrm{N}, \mathrm{F})$. $\mathrm{T}, \mathrm{N}, \mathrm{F} \in [0,1]$, $0 \leq \mathrm{T} + \mathrm{N} + \mathrm{F} \leq 1$; where $T$ is the probability that the event occurs, $N$ is the neutral probability that the event occurs or not, and $F$ is the probability that the event does not occur.

(6) Plithogenic Spherical Fuzzy Probability: When PDFs have the form $(\mathrm{T}, \mathrm{H}, \mathrm{F})$. $\mathrm{T}, \mathrm{H}, \mathrm{F} \in [0,1]$, $0 \leq \mathrm{T}^2 + \mathrm{H}^2 + \mathrm{F}^2 \leq 1$; where $T$ is the probability that the event occurs, $H$ is the neutral probability that it occurs or not, and $F$ is the probability that the event does not occur.

(7) Plithogenic (fuzzy-extension) Probability: when we have that all PDFs are in the form of (fuzzy-extension set) style.

(8) Plithogenic Hybrid Probability: When some PDFs are in one of the above styles and others are in other styles.

Plithogenic Statistics (PS) comprises the analysis and observations of the events studied by the Plithogenic Probability.

Plithogenic Statistics generalizes the classical Multivariate Statistics, which in turn allows an analysis of many output variables that are neutrosophic or indeterminate. It is also a multi-indeterminate statistic.

Various subclasses of Plithogenic Statistics are the following:

- Multivariate Statistics,
- Plithogenic Neutrosophic Statistics,
- Plithogenic Indeterminate Statistics,

- Plithogenic Intuitionistic Fuzzy Statistics,
- Plithogenic Picture Fuzzy Statistics,
- Plithogenic Spherical Fuzzy Statistics,
- and in general: Plithogenic (fuzzy-extension) Statistics,
- and Plithogenic Hybrid Statistics.

On the other hand, Plithogenic Refined Statistics are the most general form of statistics that studies the analysis and observations of the events described by the Plithogenic Refined Probability.

In classical inference statistics estimates the population's average of the variable from the sample's average.

When we have a classical random variable, the exact sample size is known and all elements of the sample belong 100% to the population. However, this does not reflect the dynamics of a population such as a student population, which is the example illustrated by F. Smarandache, where there is fluctuation of students within courses, in addition to the fact that the membership of each student varies depending on whether he or she is studying a course full-time, part-time or over -time [21-23].

In a Neutrosophic Population, each element has a triple probability of membership such that $0 \leq T_j + I_j + F_j \leq 3$.

If we assume we have the dataset $(T_j, I_j, F_j)$ for $j = 1, 2, \dots, n$, where $n$ is the sample size, then the average probability for all data in the sample is calculated by Equation 1.

$$\frac{1}{n}\sum_{j=1}^{n}(T_j, I_j, F_j) = \left(\frac{\sum_{j=1}^{n} T_j}{n}, \frac{\sum_{j=1}^{n} I_j}{n}, \frac{\sum_{j=1}^{n} F_j}{n}\right) \quad (1)$$

## 3 Results

In this section, we present the results obtained in our research. To do so, we rely on the methods used in [19].

Thirty administrative workers from the group of offices dependent on the Academic Vice-Rectorate of the National Agrarian University of La Selva participated in the collection of information to obtain salient characteristics that integrate the set of findings obtained in the study that are presented in the following tables.

| Gender | Frequency | Percentage |
|---|---|---|
| Female | 12 | 40% |
| Male | 18 | 60% |
| Total | 30 | 100% |

**Table 1.** Frequency by gender of the individuals studied.

| Age | Frequency | Percentage |
|---|---|---|
| 20–30 | 4 | 13% |
| 31–40 | 2 | 7% |
| 41–50 | 6 | 20% |
| 51–60 | 6 | 20% |
| 61–70 | 12 | 40% |
| Total | 30 | 100% |

**Table 2.** Frequency by age of the individuals studied.

| Educational level | Frequency | Percentage |
|---|---|---|
| Primary | 0 | 0% |
| Secondary | 12 | 40% |
| Non-university higher education | 4 | 13% |
| University graduate | 14 | 47% |
| Total | 30 | 100% |

**Table 3.** Frequency by the education level of the individuals studied.

| Years in the institution | Frequency | Percentage |
|---|---|---|
| 0-1 | 4 | 13% |
| >1-5 | 2 | 7% |
| >5-10 | 1 | 3% |
| >10-15 | 2 | 7% |
| >15-20 | 2 | 7% |
| >20-30 | 6 | 20% |
| >30-40 | 11 | 37% |
| >40 | 2 | 7% |
| Total | 30 | 100% |

**Table 4.** Frequency by time of service in the institution of the individuals studied.

| Years in the office | Frequency | Percentage |
|---|---|---|
| 0-1 | 8 | 27% |
| >1-5 | 8 | 27% |
| >5-10 | 2 | 7% |
| >10-15 | 2 | 7% |
| >15-20 | 4 | 13% |
| >20-30 | 5 | 17% |
| >30-40 | 1 | 3% |
| Total | 30 | 100% |

**Table 5.** Frequency by time of service in the same office of the individuals studied.

Tables 6 and 7 summarize the variables to be studied, their dimensions, and definitions.

| VARIABLE | CONCEPT | DIMENSIONS | INDICATORS |
|---|---|---|---|
| **The behavior of work teams** | It is the study of what people do in organizations and how their behavior impacts its dynamics, focusing specifically on the behavior of the organization's groups and teams. | 1. Organization | • Degree of internalization of the objectives of team organizations.<br>• Degree of internalization of the applicable regulations.<br>• Perception on structure organizational. |
| | | 2. Communication | • Degree of predisposition to assessment of results.<br>• Communication frequency is open and spontaneous. |
| | | 3. Trust | • Degree of trust to carry out the work.<br>• Perception about the disposition of mutual support.<br>• Perception about an environment of friendship, and camaraderie. |
| | | 4. Interdependence | • Perception of interdependence in the realization of activities. |
| | | 5. Belonging | • Perception of commitment to the job.<br>• Perception about identity with the office. |
| | | 6. Democratic leadership | • Perception about the joint decision-making.<br>• Perception on acceptance of points of view. |

**Table 6.** Variable to be studied "Work team behavior" (WTB), its dimensions and definitions.

| VARIABLE | CONCEPT | DIMENSIONS | INDICATORS |
|---|---|---|---|
| **Knowledge Management** | Knowledge management is the organizational activity of creating the environment social and infrastructure so that knowledge can be accessed, shared, and created. | 1. Identification | Degree of Identification of Knowledge. |
| | | 2. Generation | Degree of Generation of Knowledge. |
| | | 3. Transfer | Degree of Transfer of Knowledge. |
| | | 4. Storage | Degree of Knowledge storage. |
| | | 5. Use | Degree of use of knowledge. |
| | | 6. Measurement | Degree of Measuring knowledge. |

**Table 7.** Variable to be studied "Knowledge management" (KM), its dimensions and definitions.

The study of the WTB variable and its respective dimensions was carried out by analyzing the opinions of workers in the everyday work context. The results obtained are presented in this section.

| Classification | Frequency | Percentage |
|---|---|---|
| Group | 14 | 47% |
| Team | 16 | 53% |
| Total | 30 | 100% |

**Table 8.** Results of the classification of the behavior according to the individuals studied.

| Classification | Frequency | Percentage |
|---|---|---|
| Inadequate | 19 | 63% |
| Adequate | 11 | 37% |
| Total | 30 | 100% |

**Table 9.** Description of the dimension organization according to the individuals studied.

| Classification | Frequency | Percentage |
|---|---|---|
| Ineffective | 12 | 40% |
| Effective | 18 | 60% |
| Total | 30 | 100% |

**Table 10.** Description of the dimension communication according to the individuals studied.

| Classification | Frequency | Percentage |
|---|---|---|
| Low | 10 | 33% |
| High | 20 | 67% |
| Total | 30 | 100 |

**Table 11.** Description of the dimension of trust according to the individuals studied.

| Classification | Frequency | Percentage |
|---|---|---|
| Weak | 4 | 13% |
| Strong | 26 | 87% |
| Total | 30 | 100% |

**Table 12.** Description of the dimension interdependence according to the individuals studied.

| Classification | Frequency | Percentage |
|---|---|---|
| Low | 11 | 37% |
| High | 19 | 63% |
| Total | 30 | 100% |

**Table 13.** Description of the dimension belonging according to the individuals studied.

| Classification | Frequency | Percentage |
|---|---|---|
| Authoritarian | 14 | 47% |
| Democratic | 16 | 53% |
| Total | 30 | 100% |

**Table 14.** Description of the dimension of democratic leadership according to the individuals studied.

The study of the KM variable and its dimensions was also carried out by analyzing the opinions of workers regarding the daily work environment. The results obtained are presented in the following.

| Classification | Frequency | Percentage |
|---|---|---|
| Bad | 0 | 0% |
| Deficient | 5 | 17% |
| Acceptable | 13 | 43% |
| Good | 12 | 40% |
| Total | 30 | 100% |

**Table 15.** Classification of knowledge management according to the individuals studied.

| Classification | Frequency | Percentage |
|---|---|---|
| Bad | 3 | 10% |
| Deficient | 2 | 7% |
| Acceptable | 2 | 7% |
| Good | 23 | 77% |
| Total | 30 | 100% |

**Table 16.** Identification dimension according to the individuals studied.

| Classification | Frequency | Percentage |
|---|---|---|
| Bad | 1 | 3% |
| Deficient | 7 | 23% |
| Acceptable | 11 | 37% |
| Good | 11 | 37% |
| Total | 30 | 100% |

**Table 17.** Generation dimension according to the individuals studied.

| Classification | Frequency | Percentage |
|---|---|---|
| Bad | 1 | 3% |
| Deficient | 0 | 0% |
| Acceptable | 1 | 3% |
| Good | 28 | 93% |
| Total | 30 | 100% |

**Table 18.** Transfer dimension according to the individuals studied.

| Classification | Frequency | Percentage |
|---|---|---|
| Bad | 0 | 0% |
| Deficient | 7 | 23% |
| Acceptable | 8 | 27% |
| Good | 15 | 50% |
| Total | 30 | 100% |

**Table 19.** Storage dimension according to the individuals studied.

| Classification | Frequency | Percentage |
|---|---|---|
| Bad | 0 | 0% |
| Deficient | 2 | 7% |
| Acceptable | 2 | 7% |
| Good | 26 | 87% |
| Total | 30 | 100% |

**Table 20.** Use dimension according to the individuals studied.

| Classification | Frequency | Percentage |
|---|---|---|
| Bad | 9 | 30% |
| Deficient | 6 | 20% |
| Acceptable | 1 | 3% |
| Good | 14 | 47% |
| Total | 30 | 100% |

**Table 21.** Measurement dimension according to the individuals studied.

Each of the scales in Tables 9-21 was conveniently converted to the scale shown in Table 22.

| Linguistic Value | Associated Single-Valued Neutrosophic Number |
|---|---|
| Unfavorable | (0.1,0.1,0.8) |
| Moderately Favorable | (0.55,0.1,0.35) |
| Favorable | (0.8,0.1,0.1) |

**Table 22.** The linguistic scale and the Single-Valued Neutrosophic Numbers were used in the survey of the study carried out. Source: [19].

From the conversion, the Plithogenic Neutrosophic Probabilities were determined for each of the variables based on their dimensions using the results from the previous Tables.

These probabilities are as follows:

If $x$ is a member of the office, we have the Plithogenic Neutrosophic Probability as follows:

$PNP_{WTB}(x) = \begin{pmatrix}(0.359, 0.1, 0.541); (0.52, 0.1, 0.38); (0.569, 0.1, 0.331); (0.709, 0.1, 0.191);\\ (0.541, 0.1, 0.359); (0.471, 0.1, 0.429)\end{pmatrix}$ is the favorable Plithogenic Probability Probability about Work Team Behavior,

$PNP_{KM}(x) = \begin{pmatrix}(0.666, 0.1, 0.234); (0.5255, 0.1, 0.3745); (0.7635, 0.099, 0.1275); (0.5715, 0.1, 0.3285);\\ (0.7415, 0.101, 0.1675); (0.4425, 0.1, 0.4575)\end{pmatrix}$

is the favorable Plithogenic Probability Probability about Knowledge Management.

Now, applying the n-norm as in [19]:

$$N(x,y) = \left(\min\left(T_x, T_y\right), \max\left(I_x, I_y\right), \max\left(F_x, F_y\right)\right) \qquad (2)$$

The aggregated WTB is $(0.359, 0.1, 0.541)$ and the aggregated KM is $(0.4425, 0.101, 0.4575)$.

In addition, the study of the correlation between both variables was as follows:

$H_0$: There is a correlation between the behavior of work teams and knowledge management in offices dependent on the Academic Vice-Rectorate of UNAS,

$H_1$: There is no correlation between the behavior of work teams and knowledge management in offices dependent on the Academic Vice-Rectorate of UNAS.

Spearman's Rho test is as follows:

| Spearman's Rho test | | | |
|---|---|---|---|
| **Variables** | **Correlation Coef.** | **Sig.** | **N** |
| Work Team Behavior and Knowledge Management | | | |
| | 0.845 | 0.000 | 30 |

**Table 23.** Application table of the Spearman's correlation coefficient.

The level of correlation between the behavior of work teams and knowledge management in the offices dependent on the Academic Vice-Rectorate of UNAS is 0.84, which indicates that it is a considerable positive correlation

The Plithogenic Probability framework not only enhances traditional probabilistic modeling by incorporating neutrosophic logic, but it also enables a more refined approach to uncertainty, contradiction, and indeterminacy in statistical analyses. The ability to account for multi-dimensional sub-probabilities makes it particularly suitable for complex decision-making environments where classical probabilistic models may fall short. Recent studies have demonstrated the effectiveness of neutrosophic-based statistical methods in diverse applications, including group dynamics and teamwork analysis, as reported by Guevara et al. [24] . Their study highlights how neutrosophic probability distributions provide a better representation of human decision-making, particularly when dealing with subjective assessments that involve varying degrees of truth, falsity, and indeterminacy. Similarly, Salama et al. [25] explored the role of neutrosophic modeling in evaluating digital transformation, emphasizing that hybrid probability models offer a more adaptive and flexible approach to measuring performance in organizations where traditional metrics struggle to capture the full spectrum of uncertainty.

Furthermore, the integration of machine learning with Plithogenic Statistics has shown promising results in predictive analytics, particularly in fields such as healthcare and risk assessment. Elhawy [26] demonstrated how statistical analysis combined with machine learning optimization improves heart attack prediction, showcasing how Plithogenic Probability allows for a more comprehensive representation of medical uncertainties in patient data. This synergy between AI-driven statistical inference and Plithogenic models opens new avenues for highly adaptive data-driven decision-making, reinforcing the need for context-aware probabilistic frameworks in research domains characterized by high variability and incomplete information. The present study, by applying Plithogenic Neutrosophic Probability to workplace dynamics, further confirms the potential of these models in organizational research, paving the way for a broader adoption of neutrosophic-based methodologies across multiple disciplines.

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## Conclusion

This article was devoted to the statistical study of the correlation between two variables, "Work Team Behavior" and "Knowledge Management". The study was carried out in offices dependent on the Academic Vice-Rectorate of the National Agrarian University of La Selva, Peru. To achieve greater accuracy, a calculation was performed with the help of Neutrosophic Plithogenic Statistics. To do this, a survey was applied to 30 workers in these offices. Each of the variables above is measured by six dimensions, which are reflected in the questions in the questionnaire. The results show that there are differences between each of the dimensions. When these are aggregated together, values below Moderately Favorable are reached for both, without becoming Unfavorable. On the other hand, Spearman's Rho Coefficient is used to show that there is a notable positive correlation between the two variables. That is, the improvement of one of them will inexorably bring an improvement in the other.

The use of Plithogenic Statistics allows probabilistic calculations to be made in a multidimensional problem, where there are components of different origins. In addition, it allows the uncertainty and indeterminacy that are part of this type of phenomenon to be taken into account.

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