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Employees' Performance Measurements Using Neutrosophic Notions

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Abstract

This paper comes as an essential requirement to categorization the performance of workers (employees) in any work environment characterized by uncertainty that comes from dozens of factors, such as:

- 1- Overlapping tasks between employees' duties in the same organization and the existence of competition between them.
- 2- Evaluating the performance of all employees based on their varied abilities and their contributions to the organization.
- 3- The individual differences between the employees, in addition to the differences between the type of these employees such as a full-time employee, a part-time employee, or perhaps an employee who works more than the hours stipulated for a full-time employee.

In this manuscript, there are three new functions that have been suggested, these functions are named as:

- 1- Neutrosophic Overmembership function.
- 2- Neutrosophic Undermembership function.
- 3- Neutrosophic Offmembership function.

Keywords: Neutrosophic Physics; Neutrosophic Oversets; Neutrosophic Offsets; Neutrosophic Undersets; Neutrosophic Overmembership; Neutrosophic Undermembership; Neutrosophic Offmembership; Employees' Performance.

1 | Presentation of the Research

The research focuses on the mathematical interpretation and classification of the employees' performances in a company environment using neutrosophic single-valued Oversight, neutrosophic single-valued Offset, and neutrosophic single-valued Underset. Employees are categorized as Full-time, part-time, and Over-time workers, while their performance is evaluated according to the rate of accomplishment or lacks in the accomplishment achievements. The study introduces mathematical functions and matrices to represent the rates of reality accomplishment and reality failure to accomplish the tasks assigned to them. The proposed formalization highlights the flexibility of neutrosophic oversets, undersets, and offsets in modeling real-world uncertainty.



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2 | Introduction

In the light of the article [1-3], which is regarded as the source article, there was a consistent definition of the notions: single-valued neutrosophic Overset, single-valued neutrosophic Offset, and single-valued neutrosophic Underset. The present paper relies on the above single-valued neutrosophic sets to formulate three kinds of neutrosophic membership functions. It is well known that neutrosophic membership functions are divided into three kinds depending on the data bias, where the domains of these three functions cover three areas. The domain of the truth function covers the area positioned under the truth function; it is exactly the inverse area under the falsity function. While the area under the indeterminate function is composed of the area parts that are joint between a part of the truth membership function, with a part area under the false membership function. For more explanation about the distribution of these areas, the reader can return to the [4].

3 | Mathematical Modeling

For the sake of this paper, the authors agreed to suppose x_{ij} as the employee (i) who has the job (j). In this section, a new function $f(x_{ij})$ has been introduced to demonstrate the accomplishment (performance) of the employee (i) as well as his lackness in completing the duties assigned to finish it in a specific time.

$$f(x_{ij}) = \frac{\sum_{j=1}^n x_{ij} db_j}{L \cdot \sum_{j=1}^n Db_j} - \frac{\sum_{j=1}^n x_{ij} dt_j}{L \cdot \sum_{j=1}^n Dt_j} \quad (1)$$

x_{ij} represents the employee (i) who has job (j).

k the number of daily jobs attributable to (x_i).

n the no. of all employees in each company.

Db_j the maximum daily rate expected accomplishment in job (j) by employee (x_i).

Dt_j the maximum daily rate expected lackness made by employee (x_i) in job (j).

$db_j = [db_1, db_2, \dots, db_k]^T$ A column matrix represents the rates of reality accomplishment.

$dt_j = [dt_1, dt_2, \dots, dt_k]^T$ A column matrix represents the rates of reality lackness in the performance.

$x_{ij} = \begin{bmatrix} x_{11} & \cdots & x_{1k} \\ \vdots & \ddots & \vdots \\ x_{n1} & \cdots & x_{nk} \end{bmatrix}$ represents all (full-time, part-time, over-time) employees in all jobs.

Now to cluster all employees we must classification them as follows:

x'_{ij} is a full-time employer.

x''_{ij} is a part-time employer.

x'''_{ij} is an over-time employer.

If ($y = f(x_{ij})$) represents a full-time hour in each company, so the part-time hours would be $(\frac{y}{y-q})$ where $q \in [0, y-1-\varepsilon]$ and $0 < \varepsilon < 1$, while the over-time hours would be $24 - \frac{y}{y-q}$; consequently $x'_{ij} \in [0, 1]$, $x''_{ij} \in [0-\varepsilon, 1-\varepsilon]$, $x'''_{ij} \in [1, 1+\varepsilon]$.

(i.e. $x'_{ij} \in [0, 1]$, $x''_{ij} \in]-0, 1[$, $x'''_{ij} \in [1, 1+[$).

Note that the $0 < \varepsilon < 1$, and it may choose by a decision maker (i.e. the manager of a given company).

Really, if x'_i, x'_{i+1} both are full-time employers and they are working the same work in two different departments of a company, it is guaranty that the accuracy and the quality for both employers are different, therefore, the values of x'_i, x'_{i+1} despite of belonging to the interval $[0,1]$, but they have different values.

Because of all individual differences mentioned above, the formula of Neutrosophic Overmembership, Offmembership, and Undermembership are:

$$f(x'_i) = \frac{\sum_{j=1}^k x'_i db_j}{\sum_{j=1}^k Db_j} - \frac{\sum_{j=1}^k x'_i dt_j}{\sum_{j=1}^k Dt_j} \quad (2)$$

$$f(x''_i) = \frac{\sum_{j=1}^k x''_i db_j}{(1-\varepsilon) \sum_{j=1}^k Db_j} - \frac{\sum_{j=1}^k x''_i dt_j}{(1-\varepsilon) \sum_{j=1}^k Dt_j} \quad (3)$$

$$f(x'''_i) = \frac{\sum_{j=1}^k x'''_i db_j}{(1+\varepsilon) \sum_{j=1}^k Db_j} - \frac{\sum_{j=1}^k x'''_i dt_j}{(1+\varepsilon) \sum_{j=1}^k Dt_j} \quad (4)$$

4 | Conclusion

The proposed formalization provides a clearer interpretation of Neutrosophic Overmembership, Undermembership, and Offmembership through practical mathematical modeling. The study confirms that neutrosophic approaches are effective tools for handling uncertainty and inconsistent evaluations in real-world systems, especially in decision-making and organizational analysis. In global investment companies, this paper is regarded as original research in human resources to achieve the target in administering human resource affairs, especially in employing and measuring the employees' achievements.

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Data Availability

The datasets generated during and/or analyzed during the current study are not publicly available due to the privacy-preserving nature of the data but are available from the corresponding author upon reasonable request.

Conflicts of Interest

The authors declare that there is no conflict of interest in the research.

Ethical Approval

This article does not contain any studies with human participants or animals performed by any of the authors.

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