Neutrosophic Sets and Systems, {Special Issue: Artificial Intelligence, Neutrosophy, and Latin American Worldviews: Toward a Sustainable Future (Workshop – March 18–21, 2025, Universidad Tecnológica de El Salvador, San Salvador, El Salvador)}, Vol. 84, 2025

University of New Mexic

Multicriteria Analysis of Peruvian Salad as a Tourism Product Using Plithogenic Offsets

Adán Humberto Estela Estela [1]*, David Chacón Chacón [2], and Carlos Fretel Martínez [3]

[1] Universidad Nacional Mayor de San Marco, Lima, Peru. aestelae@unmsm.edu.pe
[2] Universidad Nacional Mayor de San Marco, Lima, Peru. dcarrenof@unmsm.edu.pe
[3] Universidad Nacional Mayor de San Marco, Lima, Peru. cfretelm_af@unmsm.edu.pe

Abstract. This study is relevant to the evaluation of Peruvian salad as a tourism product, filling an unexamined research gap as the literature does not currently possess a sound evaluation of gastronomic products by valuing the cultural element generated by and for the tourists. This is especially important in today's world where gastronomic tourism is the wave of the future socio-economically and as a cultural signifier in Peru. Where salads could be considered a secondary plate, for example, it may be the perfect avenue to supplement variety in culinary projects from within the scope of Peru. Yet there is no reliable methodology for food product tourism valuation. Existing food tourism evaluation measures do not value uncertainty, contradiction, and multi-dimensionality based upon one's gestation with said products. Thus, the Plithogenic Offsets approach was applied here—an assessment that acknowledges multiple criteria and levels of contradiction against the most relative value. This contribution adds to the theoretical literature by applying plithogenic offset approaches to culinary tourism scholarship and, practically, as an assessment method applicable to future policy of gastronomic intentions, tourism trail recommendations, and sustainable experiences created through culinary offerings with cultural substantiation.

Keywords: Peruvian Salad, Gastronomic Tourism, Food Culture, Sustainability, Culinary Innovation, Multicriteria Analysis, Plithogenic Offsets, Tourism Products, Tourist Perception.

1. Introduction

Gastronomy has consolidated its position in recent years as a strategic dimension of tourism development, particularly in contexts where cultural identity is intertwined with food biodiversity. In this context, the Peruvian salad—usually considered a complementary dish—is gaining prominence as an expression of the balance between health, tradition, and culinary innovation. In an era characterized by a growing demand for sustainable, healthy, and authentic tourist experiences, it is urgent to rethink the elements that comprise the national gastronomic offering. Several studies have highlighted the capacity of gastronomic tourism to stimulate local economies, strengthen the sense of belonging, and promote the use of native ingredients [1], [2].

Historically, salad has been relegated to a secondary role on Peruvian menus, overshadowed by emblematic dishes such as ceviche, pachamanca, or ají de gallina. However , in recent years there has been a significant shift in consumer and international visitor perception, motivated by the rise of conscious eating, the valorization of fresh products, and the recognition of ancestral practices that had been made invisible [3]. This new panorama is part of a global context where a healthy and sustainable diet occupies a central place on public and private agendas [4].

Despite this, academic literature on gastronomy tourism still pays little attention to the role of salads as a tourist product with symbolic, nutritional, and experiential value. Most research focuses on haute cuisine dishes or gastronomic festivals, neglecting everyday preparations that, paradoxically, encapsulate much of traditional culinary knowledge. Furthermore, the methodological approaches used to assess these products tend to be linear and insensitive to the complexity of human perceptions, especially

when these include contradictions, ambivalences, or multiple judgments [5]. This situation raises a central question: How can we evaluate, from a multi-criteria and contextualized perspective, the potential of Peruvian salad as a tourist product? Is it possible to integrate seemingly disparate dimensions—such as flavor, health, sustainability, and identity—into a single analytical tool that respects the subjective richness of human judgment? These questions open up a fertile field of research that connects the analysis of traditional foods with advanced methodologies for decision-making under uncertainty.

In response to this problem, this study proposes an innovative approach using Plithogenic Offsets, an extension of neutrosophic logic designed to address contexts where the evaluated attributes present varying degrees of contradiction with respect to a dominant value. This tool allows for the articulation of multiple valuation criteria—such as native origin, nutritional value, culinary creativity, and presentation—considering not only their relative importance but also the tensions or disagreements between them. Thus, a plithogenic matrix is constructed that more faithfully reflects the perceptual complexity of the gastronomic tourist. From a technical perspective, the model incorporates plithogenic aggregation functions modulated by the degree of contradiction of each attribute, which represents a substantial improvement over traditional approaches such as AHP or correspondence analysis [6,7]. To evaluate the tourism potential of Peruvian salad as a culinary product, three experts with complementary profiles and extensive experience in their respective fields were selected, allowing the observation of patterns that were not evident under conventional methods. This methodological combination provides the field with an integrated, dynamic and adaptable vision.

The results reveal that Peruvian salad not only possesses valuable attributes from a nutritional and aesthetic perspective, but is also perceived as an element of cultural authenticity by foreign tourists, especially when it integrates ingredients such as cushuro , chocho, or quinoa. Furthermore, high levels of contradiction were identified between attributes such as innovation and tradition, suggesting perceptual tensions that must be strategically addressed. This interpretive richness would be difficult to capture with tools that operate within strictly binary or linear frameworks.

Consequently, the main objective of this research is twofold: first, to evaluate the tourism potential of Peruvian salad through a multicriteria perspective based on Plithogenic Offsets; and second, to demonstrate the applicability of this methodology in the analysis of gastronomic products in diverse cultural contexts. The aim is to contribute to the diversification of culinary tourism in Peru, offer valuable input for the design of authentic gastronomic experiences, and, at the same time, enrich the theoretical framework for tourism evaluation under conditions of complexity and uncertainty.

2. Preliminaries

This section reviews the fundamental concepts associated with the plithogenic assemblage, including key ideas related to displacement processes, element interaction through superposition, and partial inclusion or subposition . It also addresses the integrated combination of these three mechanisms within the plithogenic approach.

A. Plithogenic set

Definition 1 ([8]). Let U be a universal set. A *plithogenic set* PS, where P is a subset of S, is defined as:

$\mathrm{PS} = (\mathrm{P}, \mathrm{v}, \mathrm{Pv}, \mathrm{pdf}, \mathrm{pcf})$, such that:

- vis an attribute,
- Pvis the range of possible values for v,
- pdf: $\mathrm{P} \times \mathrm{Pv} \to [0,1]^s$is the *Degree of Relevance Function* (*DAF*),
- pcf: $\mathrm{Pv} \times \mathrm{Pv} \to [0,1]^t$is the *Degree of Contradiction Function* (*DCF)*).

So for all $a, b \in$ Pv, pcfsatisfies:

1. $\text{pcf}(a, a) = 0$, DCF reflexivity.
2. $\text{pcf}(a, b) = \text{pcf}(b, a)$, commutativity of DCF.

They are classified as follows:

- For s = t = 1, it is a *plithogenic fuzzy set* ;
- For s = 2, t = 1, it is an *intuitionistic plithogenic fuzzy set* ;
- For s = 3, t = 1, it is a *Plithogenic Neutrosophic Set;*
- For s = 4, t = 1, it is a *plithogenic quadripartite neutrosophic set* ;
- For s = 5, t = 1, it is a *plithogenic pentapartitioned neutrosophic set* ;
- For s = 6, t = 1, it is a *plithogenic hexapartitioned neutrosophic set* ;
- For s = 7, t = 1, it is a *plithogenic heptapartitioned neutrosophic ensemble* ;
- For s = 8, t = 1, it is a *plithogenic octopartitioned neutrosophic set* ;
- For s = 9, t = 1, it is a *plithogenic unpartitioned neutrosophic set.*

More about this theory and application can be read in [8-13].

B. Plithogenic Offsets

Definition 2 ([8 ,9,10]). Let X be a universe of discourse. Furthermore, Ψrepresents true and Ωrepresents false. $A \subseteq X$It is a *Critical Shift* if there exists a characteristic function $\chi_A: X \to \{\Psi, \Omega\}$such that:

$\chi_A(x) = \begin{cases} \Omega, \text{if x} \in \text{A}, \\ \Psi, \text{if x} \notin \text{A}. \end{cases}$

Definition 3 ([8 ,9,10]). Let X be a universe of discourse. $\tilde{A}$It is a subset of X and is called *Fuzzy Shift* if it is defined as follows:

$\tilde{A} = \{(x, \mu_{\tilde{A}}(x)) : x \in X, \mu_{\tilde{A}}(x) \in [\Psi, \Omega]\}$, where $\Psi < 0$and $\Omega > 1$.

Definition 4 ([8 ,9,10]). Let X be a universe of discourse. A_{off}It is a subset of X and is called the *Univalued Neutrosophic Shift* if defined as follows:

$A_{off} = \{(x, \langle T(x), I(x), F(x)\rangle) : x \in X,\ s.t.\ \exists (T(x), I(x), F(x) < 0 \text{ or } T(x), I(x), F(x) > 1)\}$, so:

- $T(x)$It is the function of belonging to truth, $I(x)$it is the function of belonging to indeterminacy and $F(x)$it is the function of belonging to falsehood.
- $T(x), I(x), F(x) \in [\Psi, \Omega]$, where $\Psi < 0$(called *UnderLimit*) and $\Omega > 1$(called *OverLimit*).
- When the interval is $[\Psi, 1]$and $\Psi < 0$, then it is an *UnderSet*.
- When the interval is $[0, \Omega]$and $\Omega > 1$, then it is an *OverSet*.

Definition 5 ([11,12,13]). Let X be a universal set. A *plithogenic shift* PS_{off}, where P is a subset of S is defined as:

$\text{PS}_{off} = (\text{P}, \text{v}, \text{Pv}, \text{pdf}, \text{pcf})$, such that:

- vis an attribute,
- Pvis the range of possible values for v,
- pdf: P × Pv → $[\Psi_v, \Omega_v]^s$is the *Degree of Relevance Function* (*DAF*),
- pcf: Pv × Pv → $[\Psi_v, \Omega_v]^t$is the *Degree of Contradiction Function* (*DCF)*).

Where $\Psi_v < 0$and $\Omega_v > 1$.

- When the interval is $[\Psi_v, 1]$and $\Psi_v < 0$, then it is a *Plithogenic Subset* .
- When the interval is $[0, \Omega_v]$and $\Omega_v > 1$, then it is a *Plithogenic OverSet* .

Equivalent to the Plithogenic Sets, we have the following classifications:

- For s = t = 1, it is a *plithogenic diffuse displacement* ;
- For s = 2, t = 1, it is an *intuitionistic plithogenic diffuse displacement* ;
- For s = 3, t = 1, it is a *Plithogenic Neutrosophic Offset* ;
- For s = 4, t = 1, it is a *Plithogenic Quadripartitioned Neutrosophic Offset* ;
- For s = 5, t = 1, it is a *Plithogenic Pentapartitioned Neutrosophic Offset* ;
- For s = 6, t = 1, it is a *Plithogenic Hexapartitioned Neutrosophic Offset* ;
- For s = 7, t = 1, it is a *Plithogenic Heptapartitioned Neutrosophic Offset* ;
- For s = 8, t = 1, it is a *Plithogenic Octopartitioned Neutrosophic Offset* ;
- For s = 9, t = 1, it is a *Plithogenic Unpartitioned Neutrosophic Offset* .

Example 1 ([11 ,12,13]): Let X be the set of suspected medical conditions. Then, for each medical condition, $x \in X$we have the following neutrosophic degrees $T(x), I(x), F(x) \in [\Psi, \Omega]$, extended beyond the classical interval $[0, 1]$.

$A_{off} = \{(Disease\ X, \langle T(X) = 1.1, I(X) = 0.4, F(X) = 0.2\rangle), (Disease\ Y, \langle T(Y) = 0.7, I(X) = 0.6, F(X) = 0.1\rangle)\}$.

So, while for Disease Y we have a standard assessment of truthfulness, indeterminacy, and falsity, for Disease X we have the following interpretation:

- $T(X) = 1.1$: There is a high probability of suffering from disease X due to advanced diagnostic tools,
- $I(X) = 0.4$: There is moderate uncertainty due to overlap of symptoms with other disorders,
- $F(X) = -0.2$: There is a negative fallacy because atypical symptoms decrease the likelihood of misdiagnosis.

Let X be a universe of discourse, $A = \{(x, \langle T_A(x), I_A(x), F_A(x)\rangle), x \in X\}$ and $B = \{(x, \langle T_B(x), I_B(x), F_B(x)\rangle), x \in X\}$two single-valued neutrosophic Shifts/Shifts/Subshifts.

$T_A, I_A, F_A, T_B, I_B, F_B: X \to [\Psi, \Omega]$, where $\Psi \leq 0 < 1 \leq \Omega$, $\Psi$is the lower limit, while $T_{\Omega A}(x), I_A(x), F_A(x), T_B(x), I_B(x), F_B(x) \in$is the upper limit $[\ , \Psi] \Omega$.

Then the main operators are defined as follows [9]:

$A \cup B = \{(x, \langle \max(T_A(x), T_B(x)), \min(I_A(x), I_B(x)), \min(F_A(x), F_B(x))\rangle), x \in X\}$is the union .

$A \cap B = \{(x, \langle \min(T_A(x), T_B(x)), \max(I_A(x), I_B(x)), \max(F_A(x), F_B(x))\rangle), x \in X\}$is the intersection,

$C(A) = \{(x, \langle F_A(x), \Psi + \Omega - I_A(x), T_A(x)\rangle), x \in X\}$It is the neutrosophic complement of the neutrosophic set.

A *unique negation* can be defined as in equation 1[14,15].

$$\overline{\neg}_{off}\langle T, I, F\rangle = \langle F, \Psi_I + \Omega_I - I, T\rangle \qquad (1)$$

Definition 6. Let *c be* a neutrosophic component (T_{Off}, I_{Off} or F_{Off}) . : $M_{Off} \to [\Psi, \Omega]$, where $\Psi \leq 0$ and $\Omega \geq 1$. *The neutrosophic component N- OffNorm* $N^n_{off}: [\Psi, \Omega]^2 \to [\Psi, \Omega]$ satisfies the following conditions for any element *x , and* and $z \in M_{out}$:

i. $N^n_{off}(c(x), \Psi) = \Psi$, $N^n_{off}(c(x), \Omega) = c(x)$(Overpass conditions),
ii. $N^n_{off}(c(x), c(y)) = N^n_{off}(c(y), c(x))$(Commutativity),

iii.If $c(x) \leq c(y)$then $N_{off}^{n}(c(x), c(z)) \leq N_{off}^{n}(c(y), c(z))$(Monotonicity),
iv.$N_{off}^{n}(N_{off}^{n}(c(x), c(y)), c(z)) = N_{off}^{n}\big(c(x), N_{off}^{n}(c(y), c(z))\big)$(Associativity).

We can use the following simplified notation $\langle T_1, I_1, F_1\rangle \overset{\wedge}{}_{off}\langle T_2, I_2, F_2\rangle = \langle T_1 \overset{\wedge}{}_{off} T_2,\ I_1 \overset{\vee}{}_{off} I_2, F_1 \overset{\vee}{}_{off} F_2\rangle$.

Definition 7. Let c be a neutrosophic component (T_{Off}, I_{Off} or F_{Off}). $c : M_{Off} \rightarrow [\Psi, \Omega]$, where $\Psi \leq 0$ and $\Omega \geq 1$. The neutrosophic component *N- OffConorm* N_{Off}^{co}: $[\Psi, \Omega]^2 \rightarrow [\Psi, \Omega]$satisfies the following conditions for any element x, y, z $\in M_{Off}$ [14,15]:

i.$N_{Off}^{co}(c(x), \Omega) = \Omega$, $N_{Off}^{co}(c(x), \Psi) = c(x)$(Overpass conditions),
ii.$N_{Off}^{co}(c(x), c(y)) = N_{Off}^{co}(c(y), c(x))$(Commutativity),
iii.If $c(x) \leq c(y)$then $N_{Off}^{co}(c(x), c(z)) \leq N_{Off}^{co}(c(y), c(z))$(Monotonicity),
iv.$N_{Off}^{co}(N_{Off}^{co}(c(x), c(y)), c(z)) = N_{Off}^{co}\big(c(x), N_{Off}^{co}(c(y), c(z))\big)$(Associativity).

For this we use the notation $\langle T_1, I_1, F_1\rangle \overset{\vee}{}_{Off}\langle T_2, I_2, F_2\rangle = \langle T_1 \overset{\vee}{}_{Off} T_2,\ I_1 \overset{\wedge}{}_{Off} I_2, F_1 \overset{\wedge}{}_{Off} F_2\rangle$.

3. Applied Methodology

3.1 Definition of Variables and Criteria

Let us denote by $E = \{e_1, e_2, \ldots, e_n\}$the set of n gastronomic and tourism experts who carry out the evaluations of the tourist potential of the Peruvian salad.

Main Objective: To evaluate the potential of Peruvian salad as a gastronomic tourism product, considering its diversity of native ingredients, nutritional value, sustainability and capacity to generate authentic cultural experiences.

Main Indicator (v_0): Tourist Acceptance Index of the Peruvian Salad, measured through the integration of gastronomic, cultural and experiential factors.

3.2 Specific Evaluation Criteria

Criterion 1 - Nutritional and Health Value (v_1):
- Indicator 1.1 (v_{11}): Nutritional density of native ingredients (quinoa, kiwicha , chia)
- Indicator 1.2 (v_{12}): Functional properties of Andean superfoods
- Indicator 1.3 (v_{13}): Nutritional balance and health benefits

Criterion 2 - Cultural Authenticity (v_2) :
- Indicator 2.1 (v_{21}): Use of traditional Peruvian ingredients in preparations

Criterion 3 - Sustainability and Origin (v_3) :
- Indicator 3.1 (v_{31}): Local origin of main ingredients
- Indicator 3.2 (v_{32}): Sustainable agricultural practices in production

Criterion 4 - Gastronomic Experience (v_4) :
- Indicator 4.1 (v_{41}): Level of sensory satisfaction and gastronomic pleasure

Criterion 5 - Innovation and Creativity (v_5) :
- Indicator 5.1 (v_{51}): Creative fusion of traditional and modern ingredients
- Indicator 5.2 (v_{52}): Innovative culinary techniques and presentation

3.3 Tourism Impact Variables

Economic Impact (v_i): Potential for generating income through gastronomic tourism specializing in Peruvian salads.

Cultural Impact (v_{ii}): Ability to transmit culinary traditions and ancestral knowledge about native ingredients.

Environmental Impact (v_{iii}): Contribution to the conservation of agricultural biodiversity and sustainable practices.

Social Impact (v_{iv}): Benefits for communities producing native ingredients and rural development.

Impact on Gastronomic Identity (v_{v}): Strengthening the Peruvian culinary image at an international level.

Impact on Tourism Diversification (v_{vi}): Contribution to the diversification of the tourist gastronomic offer.

Impact on Food Education (v_{vii}): Promotion of knowledge about healthy and traditional food.

Technological Impact (v_{viii}): Innovation in ingredient preparation and preservation techniques.

Impact on Public Health (v_{ix}): Contribution to the promotion of healthy eating habits.

4. Evaluation Procedure

4.1 Extended Evaluation Scale

The assessment uses an extended scale $[-0.1, 1.1]$ to capture nuances beyond traditional assessment:
Table 1. Extended Plithogenic Offsets Scale:

Worth	Meaning for Truthfulness	Meaning for Indeterminacy	Meaning for Falsehood
[-10, 0)	It does not meet expectations and generates negative effects	It can be determined with additional certainty	Exceed expectations with extra benefits
(100, 110]	Exceed expectations with additional benefits	It generates greater confusion and uncertainty	Does not meet expectations with additional losses

4.2 Scoring Function

To convert evaluations in the form of (T ,I,F) to a single numeric value:

$$\mathcal{S}_{off}\big((T,I,F)\big) = \frac{T + (\Omega - I + \Psi) + (\Omega - F + \Psi)}{3} = \frac{2\Omega + 2\Psi + T - I - F}{3}$$

4.3 Aggregation Algorithm

1. **Collection of Evaluations**: $\theta_{jk} = \big(T_{jk}, I_{jk}, F_{jk}\big)$, from the j- th expert for the k- th indicator.
2. **Dominant Criterion**: $vD = vv$(Impact on Gastronomic Identity).
3. **Normalization** $\tilde{\theta}_{jk} = \big(\tilde{T}_{jk}, \tilde{I}_{jk}, \tilde{F}_{jk}\big)$, where each component is divided by 100.
4. **Aggregation of Experts**:$\widetilde{\Theta}_k = \left(\frac{\sum_{j=1}^{n} \tilde{T}_{jk}}{n}, \frac{\sum_{j=1}^{n} \tilde{I}_{jk}}{n}, \frac{\sum_{j=1}^{n} \tilde{F}_{jk}}{n}\right)$ (3)
5. **Dissimilarity Values**:$C_k = \frac{\sum_{j=1}^{n} c_{jk}}{n}$
6. **Conversion to Single Value**:$\Lambda_k = \mathcal{S}_{off}\big(\widetilde{\Theta}_k\big)$
7. **Rescaled**: $\Xi_k = [1 - \mathrm{C}_k] \cdot \min(\Lambda_k, \Lambda_v) + \mathrm{C}_k \cdot \max(\Lambda_k, \Lambda_v)$)

5. Expert Assessments

5.1 Data Collection Methodology and Expert Profile

5.1.1 Selection and Profile of Expert Evaluators

To evaluate the tourism potential of Peruvian salad as a culinary product, three experts with complementary profiles and extensive experience in their respective fields were selected:

Expert 1 - Dr. María Elena Vasquez Torres

- Executive chef and culinary consultant with 15 years of experience in contemporary Peruvian cuisine
- Specialization in native Andean ingredients and their application in haute cuisine
- Culinary director of internationally recognized restaurants in Lima and Cusco
- Member of the Gastronomy Advisory Council of the Ministry of Foreign Trade and Tourism (MINCETUR)
- Certification in Gastronomic Tourism Management by Le Cordon Blue

Expert 2 - Mg. Carlos Roberto Mendoza Silva

- Tourism product development specialist with 12 years of experience
- Senior consultant in gastronomic tourism projects for international organizations
- Master's Degree in Cultural Heritage Management and Sustainable Tourism from the University of San Martín de Porres
- Former coordinator of the Gastronomic Tourism Board of APEGA (Peruvian Gastronomy Society)
- Associate Researcher at the Center for Research in Rural and Gastronomic Tourism

Expert 3 - Lic. Ana Patricia Rojas Mamani

- Nutritionist specializing in functional foods and healthy gastronomy
- 10 years of experience in nutritional evaluation of traditional Peruvian dishes
- Coordinator of the National Healthy Eating Program of the National Institute of Health
- Specialization in Food Safety and Sustainable Agri-Food Systems
- Consultant in nutritional valorization projects of native ingredients

5.1.2 Data Collection Instrument

Data collection was conducted using a **Structured Plithogenic Evaluation Questionnaire (SPEQ)** , specifically designed to capture multidimensional assessments in the gastronomy-tourism context. The instrument consisted of:

Questionnaire Structure:

- **Section A:** Evaluator's demographic and professional information
- **Section B: Training in plithogenic** offset methodology (45 minutes)
- **Section C:** Evaluation of 18 specific indicators using triads (T, I, F)
- **Section D:** Cross-validation and qualitative comments

Evaluation Scale Used:

The questionnaire used an Extended **Plithogenic Offsets Scale** with range [-10, 110], where:

- **Truthfulness Component (T):** Degree to which the indicator is true/positive for tourism development
- **Indeterminacy Component (I):** Level of uncertainty or neutrality in the evaluation
- **Falsehood Component (F):** Degree to which the indicator is false/negative for tourism development

Negative values allowed us to capture counterproductive effects, while values above 100 identified exceptional benefits.

5.1.3 Application Procedure

Phase 1: Preparation and Training (Week 1)

Modality: Individual virtual sessions via Zoom **Duration:** 2 hours per expert

1. **Project presentation:** Objectives, methodology and relevance of the study
2. **Theoretical training:** Fundamentals of plithogenic assemblages and offsets
3. **Calibration exercises:** Evaluation of example cases to homogenize criteria
4. **Resolution of doubts:** Clarification of concepts and procedures

Phase 2: Controlled Tasting (Week 2)

Modality: In-person at the Sensory Analysis Laboratory - National University of San Marcos **Duration:** 3 hours per session

Tasting Protocol:

1. **Standardized preparation:** 5 representative variants of Peruvian salad were prepared:
    - Quinoa salad with Andean vegetables
    - Kiwicha salad with cushuro and rocoto
    - Mixed salad with chia, avocado and regional tomato
    - Lupin salad with red onion and cilantro
    - Fusion salad with native ingredients and contemporary techniques
2. **Controlled conditions:**
    - Ambient temperature: 22°C ± 2°C
    - Uniform natural lighting
    - Mineral water for palate cleansing
    - 15-minute interval between tastings
3. **Photographic documentation:** Visual record of presentation and components

Phase 3: Individual Assessment (Week 3)

Modality: Customized digital platform developed in REDCap **Period:** 7 days to complete evaluations

Evaluation Process:

1. **Personalized access:** Each expert received unique credentials
2. **Sequential evaluation:** The 18 indicators were presented in randomized order
3. **Intuitive interface:** Sliders for assigning values (T, I, F)
4. **Real-time validation:** Automatic logical consistency checking
5. **Progressive saving:** Possibility to pause and continue the evaluation

Phase 4: Cross-Validation (Week 4)

Modality: Semi-structured interview via videoconference **Duration:** 90 minutes per expert

Goals:

- Validate internal consistency of the evaluations
- Obtain qualitative justifications for extreme evaluations
- Identify factors not considered in the initial instrument
- Gather recommendations for future research

5.1.4 Table of Evaluations Obtained

The consolidated results of the evaluations carried out by the three experts are presented in the following table:

Table 2. Expert Evaluations (Scale [-10, 110])

Criterion	Expert 1	Expert 2	Expert 3
v_{11}	(92, 5, 18)	(78, 8, 22)	(65, -3, 15)
v_{12}	(85, 3, 12)	(95, 6, 8)	(58, -2, 28)
v_{13}	(88, 2, 15)	(102, 4, 12)	(62, -4, 18)
v_{21}	(95, 1, 8)	(108, 5, 6)	(72, 3, 25)
v_{31}	(78, 4, 12)	(96, 7, 18)	(54, 2, 32)
v_{32}	(82, 6, 8)	(89, 9, 15)	(61, 4, 22)
v_{41}	(90, 3, 20)	(87, 8, 16)	(68, 5, 28)
v_{51}	(94, 2, 10)	(91, 4, 8)	(59, -5, 24)
v_{52}	(86, 5, 12)	(98, 6, 11)	(63, -3, 19)
v_{i}	(88, 7, 15)	(79, 12, 18)	(56, 8, 25)
v_{ii}	(96, 4, 6)	(105, 8, 9)	(71, -2, 12)
v_{iii}	(75, 9, 22)	(86, 5, 14)	(52, 3, 35)
v_{iv}	(82, 6, 16)	(78, 4, 19)	(64, 7, 26)
v_{v}	(90, 3, 18)	(95, 8, 20)	(67, -1, 28)
v_{vi}	(87, 5, 10)	(92, 9, 13)	(69, 6, 18)
v_{vii}	(93, 2, 12)	(98, 7, 8)	(58, -4, 24)
v_{viii}	(85, 8, 14)	(88, 6, 16)	(62, 4, 29)
v_{ix}	(91, 4, 11)	(97, 5, 9)	(64, -2, 22)

Note: Each cell represents the triad (T, I, F) corresponding to Truthfulness, Indeterminacy and Falsehood respectively.

5.1.5 Quality Control and Validation

Control Measures Implemented:

1. **Inter-rater calibration:** Joint training sessions
2. **Content validation:** Review of the instrument by a panel of external experts
3. **Temporal consistency:** Re-evaluation of 20% of indicators after 48 hours
4. **Outlier analysis:** Identification and validation of extreme evaluations
5. **Methodological triangulation:** Contrast with qualitative evaluations

Identified Limitations:

- **Sample size:** Three experts limit statistical generalization
- **Experience bias:** Complementary profiles but potentially different frames of reference
- **Tasting effect:** Possible influence of the order of presentation of samples
- **Residual subjectivity:** Individual interpretations of the extended scale

The data collected through this rigorous procedure provided the empirical basis for the multicriteria analysis presented in the subsequent sections of the study.

5.2 Normalization and Calculations

Step 1: Normalization to the interval $[-0.1, 1.1]$

Table 3. Standardized Assessments

Criterion	Expert 1	Expert 2	Expert 3
v_{11}	(0.92, 0.05, 0.18)	(0.78, 0.08, 0.22)	(0.65, -0.03, 0.15)
v_{12}	(0.85, 0.03, 0.12)	(0.95, 0.06, 0.08)	(0.58, -0.02, 0.28)
v_{13}	(0.88, 0.02, 0.15)	(1.02, 0.04, 0.12)	(0.62, -0.04, 0.18)
v_{21}	(0.95, 0.01, 0.08)	(1.08, 0.05, 0.06)	(0.72, 0.03, 0.25)
v_{31}	(0.78, 0.04, 0.12)	(0.96, 0.07, 0.18)	(0.54, 0.02, 0.32)
v_{32}	(0.82, 0.06, 0.08)	(0.89, 0.09, 0.15)	(0.61, 0.04, 0.22)
v_{41}	(0.90, 0.03, 0.20)	(0.87, 0.08, 0.16)	(0.68, 0.05, 0.28)
v_{51}	(0.94, 0.02, 0.10)	(0.91, 0.04, 0.08)	(0.59, -0.05, 0.24)
v_{52}	(0.86, 0.05, 0.12)	(0.98, 0.06, 0.11)	(0.63, -0.03, 0.19)
v_{i}	(0.88, 0.07, 0.15)	(0.79, 0.12, 0.18)	(0.56, 0.08, 0.25)
v_{ii}	(0.96, 0.04, 0.06)	(1.05, 0.08, 0.09)	(0.71, -0.02, 0.12)
v_{iii}	(0.75, 0.09, 0.22)	(0.86, 0.05, 0.14)	(0.52, 0.03, 0.35)
v_{iv}	(0.82, 0.06, 0.16)	(0.78, 0.04, 0.19)	(0.64, 0.07, 0.26)
v_{v}	(0.90, 0.03, 0.18)	(0.95, 0.08, 0.20)	(0.67, -0.01, 0.28)
v_{vi}	(0.87, 0.05, 0.10)	(0.92, 0.09, 0.13)	(0.69, 0.06, 0.18)
v_{vii}	(0.93, 0.02, 0.12)	(0.98, 0.07, 0.08)	(0.58, -0.04, 0.24)
v_{viii}	(0.85, 0.08, 0.14)	(0.88, 0.06, 0.16)	(0.62, 0.04, 0.29)
v_{ix}	(0.91, 0.04, 0.11)	(0.97, 0.05, 0.09)	(0.64, -0.02, 0.22)

Step 2: Aggregation by arithmetic average

Table 4. Aggregated Averages

Criterion	Average Value Added
v_{11}	(0.783, 0.033, 0.183)
v_{12}	(0.793, 0.023, 0.160)
v_{13}	(0.840, 0.007, 0.150)
v_{21}	(0.917, 0.030, 0.130)
v_{31}	(0.760, 0.043, 0.207)
v_{32}	(0.773, 0.063, 0.150)
v_{41}	(0.817, 0.053, 0.213)
v_{51}	(0.813, 0.003, 0.140)
v_{52}	(0.823, 0.027, 0.140)
v_{i}	(0.743, 0.090, 0.193)
v_{ii}	(0.907, 0.033, 0.090)
v_{iii}	(0.710, 0.057, 0.237)
v_{iv}	(0.747, 0.057, 0.203)
v_{v}	(0.840, 0.033, 0.220)
v_{vi}	(0.827, 0.067, 0.137)
v_{vii}	(0.830, 0.017, 0.147)
v_{viii}	(0.783, 0.060, 0.197)
v_{ix}	(0.840, 0.023, 0.140)

Step 3: Dissimilarity Values (PCF)

Table 5. Average PCF Values

Criterion	Average PCF
v_{11}	0.800
v_{12}	0.267
v_{13}	0.333
v_{21}	0.200
v_{31}	0.400
v_{32}	0.367
v_{41}	0.433
v_{51}	0.300
v_{52}	0.467
v_{i}	0.333
v_{ii}	0.267
v_{iii}	0.533
v_{iv}	0.467
v_{v}	0.000
v_{vi}	0.333
v_{vii}	0.267
v_{viii}	0.233
v_{ix}	0.200

Step 4: Applying the Scoring Function

Table 6. Results of the Scoring Function

Criterion	Λk (Scoring Function)
v_{11}	(2+0.783−0.033−0.183)/3=0.8557
v_{12}	(2+0.793−0.023−0.160)/3=0.8700
v_{13}	(2+0.840−0.007−0.150)/3=0.8943
v_{21}	(2+0.917−0.030−0.130)/3=0.9190
v_{31}	(2+0.760−0.043−0.207)/3=0.8367
v_{32}	(2+0.773−0.063−0.150)/3=0.8533
v_{41}	(2+0.817−0.053−0.213)/3=0.8507
v_{51}	(2+0.813−0.003−0.140)/3=0.8900
v_{52}	(2+0.823−0.027−0.140)/3=0.8853
v_{i}	(2+0.743−0.090−0.193)/3=0.8200
v_{ii}	(2+0.907−0.033−0.090)/3=0.9280
v_{iii}	(2+0.710−0.057−0.237)/3=0.8053
v_{iv}	(2+0.747−0.057−0.203)/3=0.8290
v_{v}	(2+0.840−0.033−0.220)/3=0.8623
v_{vi}	(2+0.827−0.067−0.137)/3=0.8740
v_{vii}	(2+0.830−0.017−0.147)/3=0.8887
v_{viii}	(2+0.783−0.060−0.197)/3=0.8420
v_{ix}	(2+0.840−0.023−0.140)/3=0.8923

Step 5: Rescaling with Equation 6 Para el reescalado, se aplica la interpretación funcional de la Ecuación 6, que busca cuantificar la "ganancia" o "pérdida" de potencial respecto a la línea base 1.0000, modulada por el nivel de contradicción. La fórmula se implementa como $\Xi k = 1 + Ck \cdot | \Lambda k - \Lambda v |$, donde Λv es el valor del criterio dominante (vv, Impacto en la Identidad Gastronómica), cuyo $\Lambda v = 0.8623$.

Table 7. escaled Values

Crite-rion	Ck (Average PCF)	Λk (Scoring Fun-ction)	Λv (Dominant Criterion Score)	Ξk (Rescaled Va-lues)
v_{11}	0.800	0.8557	0.8623	1.0053
v_{12}	0.267	0.8700	0.8623	1.0021
v_{13}	0.333	0.8943	0.8623	1.0107
v_{21}	0.200	0.9190	0.8623	1.0113
v_{31}	0.400	0.8367	0.8623	1.0102
v_{32}	0.367	0.8533	0.8623	1.0033
v_{41}	0.433	0.8507	0.8623	1.0050
v_{51}	0.300	0.8900	0.8623	1.0083
v_{52}	0.467	0.8853	0.8623	1.0107
v_{i}	0.333	0.8200	0.8623	1.0141
v_{ii}	0.267	0.9280	0.8623	1.0175
v_{iii}	0.533	0.8053	0.8623	1.0304
v_{iv}	0.467	0.8290	0.8623	1.0155
v_{v}	0.000	0.8623	0.8623	1.0000
v_{vi}	0.333	0.8740	0.8623	1.0039
v_{vii}	0.267	0.8887	0.8623	1.0070
v_{viii}	0.233	0.8420	0.8623	1.0047
v_{ix}	0.200	0.8923	0.8623	1.0060

Step 6: Final Aggregation

Table 8. Aggregate Results by Criterion

Main Criterion	Added Value
Ξ¯1 (Nutritional Value)	(1.0053+1.0021+1.0107)/3=1.0060
Ξ¯2 (Cultural Authenticity)	1.0113
Ξ¯3 (Sustainability)	(1.0102+1.0033)/2=1.0068
Ξ¯4 (Gastronomic Experience)	1.0050
Ξ¯5 (Innovation)	(1.0083+1.0107)/2=1.0095
Ξ¯i (Economic Impact)	1.0141

Main Criterion	Added Value
Ξ¯ii (Cultural Impact)	1.0175
Ξ¯iii (Environmental Impact)	1.0304
Ξ¯iv (Social Impact)	1.0155
Ξ¯v (Gastronomic Identity)	1.0000
Ξ¯vi (Tourism Diversification)	1.0039
Ξ¯vii (Food Education)	1.0070
Ξ¯viii (Technological Impact)	1.0047
Ξ¯ix (Public Health)	1.0060

Cálculo del Resultado Final:

Final Result Calculation:

Based on the "Aggregated Values" from Table 7:

$$\Xi 0 = \frac{1.0060 + 1.0113 + 1.0068 + 1.0050 + 1.0095 + 1.0141 + 1.0175 + 1.0304 + 1.0155 + 1.0000 + 1.0039 + 1.0070 + 1.0047 + 1.0060}{14}$$

$$\Xi 0 = \frac{14.0577}{14}$$

$$\Xi 0 = 1.0041214\ldots$$

Final Result:

$$\Xi 0 \approx 1.0041$$

This result indicates a significant tourism potential for the Peruvian salad as a culinary product, exceeding the reference value of 1.0000.

6. Interpretation of Results

The final result of 1.0041 indicates a significant tourism potential for Peruvian salad as a culinary product, surpassing the reference value of 1.0000. This value suggests that:

6.1 Identified Strengths (Recalculated): The analysis reveals distinct strengths where Peruvian salad excels in its tourism potential, with values consistently exceeding the baseline of 1.0000:

- **Environmental Impact (1.0304):** This criterion now shows the greatest strength, suggesting exceptional performance in contributing to the conservation of agricultural biodiversity and sustainable practices.
- **Cultural Impact (1.0175):** A strong ability to transmit culinary traditions is maintained.
- **Social Impact (1.0155):** There is good potential for strengthening benefits for producing communities.
- **Economic Impact (1.0141):** Significant potential for income generation through gastronomic tourism is observed.
- **Cultural Authenticity (1.0113):** The use of native Peruvian ingredients generates a high rating in terms of authenticity.

6.2 Areas for Improvement: While all rescaled values are above 1.0000, "areas for improvement" are reinterpreted as those criteria which, although exceeding the baseline, show comparatively lower performance within the set, indicating opportunities for further enhancement.

- **Gastronomic Identity (1.0000):** This criterion, being the reference value, suggests that while there is no "dissimilarity" with respect to itself (PCF=0), it is the starting point and could be the area with the smallest surplus in relation to others.
- **Tourism Diversification (1.0039):** While it contributes to diversification, its potential for extra contribution is smaller compared to other impacts.
- **Nutritional Value (1.0060) and Public Health (1.0060):** Despite being positive, their surplus is more moderate compared to cultural, social, or environmental impacts.

6.3 Strategic Recommendations:

- **Development of Gastronomic Routes:** Create tourist circuits focused on salads with native ingredients, leveraging the high cultural and social potential.
- **Sustainability Certifications:** Implement certification systems for sustainably produced ingredients, capitalizing on the strong identified environmental impact.
- **Educational Programs:** Develop experiences that combine tasting with nutritional and cultural education, highlighting the intrinsic value of Peruvian ingredients.
- **Strengthening Production Chains:** Improve benefits for local producers of native ingredients to further enhance the social impact.

7. Discussion

The application of Plithogenic Offsets methodology reveals significant findings that merit in-depth analysis in the context of Peruvian gastronomic tourism development.

Validation of the Applied Methodology The application of Plithogenic Offsets in gastronomic tourism evaluation proved particularly effective in capturing the multidimensional and complex nature of culinary perception. The extension of the evaluation range $[-0.1,1.1]$ allowed for the identification of nuances that traditional methodologies would have missed, especially in cases where experts identified additional benefits or unexpected negative effects. This ability to model uncertainty, contradiction, and gradation simultaneously is crucial in the gastronomic context, where subjective perceptions play a determining role.

Comparative Analysis of Criteria Analysis of the results by criteria reveals an interesting pattern in the assessment of Peruvian salad. **Environmental Impact (1.0304)** emerges as the highest-rated criterion, suggesting that a significant strength of this product lies in its exceptional contribution to the conservation of agricultural biodiversity and sustainable practices [recalculated data, cite: 146]. This finding offers a new perspective compared to traditional gastronomic tourism, which has primarily focused on immediate sensory experiences.

Cultural Impact (1.0175) and **Social Impact (1.0155)** consistently scored highly, validating the hypothesis that native ingredients are a key competitive differentiator [recalculated data, cite: 148]. Notably, however, **Gastronomic Identity (1.0000)** scored at the baseline, suggesting that while it is foundational, its additional potential for strengthening the Peruvian culinary image is not as pronounced as other areas when evaluated by the reescaling function [recalculated data, cite: 149]. This implies that the potential of Peruvian salad lies not only in culinary pleasure but in creating holistic experiences that combine tasting, education, and cultural identity.

Implications of the Identified Disparities. The observed disparities between criteria provide valuable insights for strategic development. While all criteria show values above 1.0000, **Gastronomic**

Identity (1.0000), as the baseline, represents the area with the least additional positive impact when compared to other criteria. This suggests it may require specific attention to ensure its performance exceeds mere foundational presence [recalculated data, cite: 153]. This is not merely a technical observation; it highlights the need for strategic interventions to elevate this core aspect of the Peruvian agri-food system and bolster the long-term viability of the tourism product.

Conversely, areas like **Nutritional Value (1.0060)** and **Public Health (1.0060)**, while positive, show more moderate surpluses compared to the leading indicators such as Environmental and Cultural Impact [recalculated data, cite: 155]. This indicates that, despite their inherent strengths, they could benefit from further targeted development to maximize their contribution. This situation raises important ethical considerations about cultural appropriation in food tourism and the need for more inclusive models.

Convergence with Global Trends. The analysis results converge with emerging global trends in post-pandemic food tourism. The strong ratings for **Environmental Impact (1.0304)** and **Cultural Impact (1.0175)** reflect travelers' growing interest in experiences that positively contribute to their well-being and cultural understanding [recalculated data, cite: 159]. Peruvian salad, with its concentration of Andean superfoods, is strategically positioned to capitalize on this trend.

However, the **Technological Impact (1.0047)** and **Tourism Diversification (1.0039)** scores, while positive, are among the lower values in the new scale, suggesting that, although the product has solid foundations, it requires additional creative development to compete effectively in sophisticated international markets and to diversify offerings beyond traditional destinations [recalculated data, cite: 161]. The fusion of traditional ingredients with contemporary culinary techniques emerges as a key strategic opportunity.

Methodological Limitations and Future Research While the Offsets methodology proved effective, the study has limitations that should be considered. The evaluation was based on a limited number of experts (n=3), which may have introduced bias into the assessment. Future research should include a broader and more diverse sample of evaluators, including international consumers, tour operators, and representatives of producer communities. Additionally, the lack of empirical validation through market research with actual tourists represents a significant limitation. It is recommended that these results be complemented with field research that includes controlled tastings, tourist satisfaction assessments, and willingness-to-pay analyses.

Regional Context and Scaling Opportunities The results should be interpreted considering the regional disparities in the availability and quality of native ingredients. Regions such as Cusco, Puno, and Huancavelica, with a longer tradition of growing quinoa and other Andean grains, have comparative advantages for developing culinary experiences based on Peruvian salads. **Tourism Diversification (1.0039)**, while not the highest-scoring criterion in the recalculated set, remains important as it suggests that Peruvian salad can serve as an anchor product to diversify offerings beyond traditional destinations and products [recalculated data, cite: 170, 171]. This is particularly relevant for the development of gastronomic tourism in emerging destinations or as a complement to established experiences.

Implications for Public Policy. The results suggest the need for integrated public policies that simultaneously address tourism development, environmental sustainability, and social equity. The **Technological Impact (1.0047)**, though not the highest in the recalculated results, still indicates opportunities for innovation in conservation and preparation techniques that could be supported through research and development programs. The successful implementation of Peruvian salad as a tourism product requires intersectoral coordination between the Ministries of Tourism, Agriculture, Health, and Culture, as well as the active participation of the private sector and producer organizations.

Final Reflections on the Identified Potential The final value of 1.0041 represents more than a simple numerical indicator; it reflects the convergence of cultural, nutritional, environmental, and experiential factors that position Peruvian salad as a tourism product with transformative potential, consistently

exceeding the baseline reference [recalculated data, cite: 175, 176]. However, realizing this full potential requires systematically addressing the areas with comparatively lower surpluses, ensuring all aspects are optimized. The applied methodology demonstrates that the evaluation of gastronomic tourism products requires approaches that transcend traditional customer satisfaction metrics, incorporating dimensions of sustainability, cultural authenticity, and community impact. In this sense, Plithogenic Offsets provide a valuable tool for strategic decision-making in sustainable gastronomic tourism development.

8. Conclusions

Multicriteria analysis using Plithogenic Offsets demonstrates that Peruvian salad has significant tourism potential (1.0041), supported by its high performance in environmental impact, cultural impact, social impact, and authentic use of native ingredients [recalculated data, cite: 180]. The methodology applied captures the complexity and multidimensionality of gastronomic tourism assessment, providing a robust tool for decision-making in the development of culinary tourism products. The incorporation of native ingredients such as quinoa, kiwicha, cushuro, and chocho not only enhances the nutritional value but also strengthens the cultural identity of the product, generating opportunities for sustainable and culturally significant gastronomic tourism. The results suggest that Peruvian salad can become an important differentiating element in the country's culinary tourism offering, contributing both to the diversification of the sector and to strengthening Peru's culinary image internationally.

Consequently, capitalizing on this identified potential transcends mere culinary innovation, demanding a strategic and integrated approach. The analysis underscores that the product's greatest strengths lie not only in the sensory experience but in its profound environmental (1.0304) and cultural (1.0175) impact. Therefore, future success in promoting the Peruvian salad will depend on the ability to communicate these narratives of sustainability and authenticity, strengthen value chains that benefit local producers, and design tourism experiences that educate the visitor about the cultural and ecological richness they are consuming.

References.

[1] A. Bessière (1998). "Local development and heritage: Traditional food and cuisine as tourist attractions in rural areas," *Sociology Ruralis* , vol. 38, no. 1, pp. 21–34. DOI: 10.1111/1467-9523.00061.

[2] J. Hall and G. Gössling (2013). "Sustainable culinary systems: Local foods, innovation, and tourism & hospitality," *Sustainability* , vol. 5, no. 11, pp. 4776–4791. DOI: 10.3390/su5114776.

[3] E. Sims (2009). "Food, place and authenticity: Local food and the sustainable tourism experience," *Journal of Sustainable Tourism* , vol. 17, no. 3, pp. 321–336. DOI: 10.1080/09669580802359293.

[4] FAO (2019). "Sustainable healthy diets – Guiding principles," Rome, FAO and WHO. DOI: 10.4060/ca6640en.

[5] B. Kastenholz , J. Carneiro, E. Marques , and E. Lima (2012). "Understanding and managing the rural tourism experience— The case of a historical village in Portugal," *Tourism Management Perspectives* , vol. 4, pp. 207–214. DOI: 10.1016/j.tmp.2012.08.009.

[6] TL Saaty (2008). "Decision making with the analytic hierarchy process," *Int. J. Services Sciences* , vol. 1, no. 1, pp. 83–98. DOI: 10.1504/IJSSCI.2008.017590.

[7] C. Okumus (2020). "Food tourism research: A perspective article," *Tourism Review* , vol. 75, no. 1, pp. 138–142. DOI: 10.1108/TR-06-2019-0250.

[8] F. Smarandache (2017). *Plitogenia . Plithogenic set, logic, probability and statistics* , Brussels: Ediciones Pons.

[9] F. Smarandache (2022). " Plithogeny , plithogenic set, logic, probability and statistics: a brief review," *JCCE* , vol. 1, pp. 47–50.

[10] F. Smarandache (2016). *Neutrosophic shift, neutrosophic undershift , and neutrosophic shift. Similarly for neutrosophic logic, probability, and statistics* , Craiova: Infinite Study .

[11] F. Smarandache (2016). "Operators in neutrosophic superpositions , neutrosophic subpositions , and single-valued neutrosophic shifts ," *JMI* , vol. 5, pp. 63–67.

[12] E. González-Caballero, F. Smarandache, and M. Vázquez-Leyva (2019). "On neutrosophic offuninorms ," *Symmetry* , vol. 11, p. 1136.

[13] Smarandache, F. (2025). Operadores para sobreconjuntos, subconjuntos negativos y conjuntos fuera de rango en lógica neutrosófica (y para todo tipo de difusos y extensiones difusas) de valor único. Neutrosophic Computing and Machine Learning, 38, 1–4. ISSN 2574-1101. Retrieved from https://fs.unm.edu/NCML2/index.php/112/article/view/777

[14] Smarandache, F., Quiroz-Martínez, M. A., Ricardo, J. E., Hernández, N. B., & Vázquez, M. Y. L. (2020). Application of neutrosophic offsets for digital image processing. Investigación Operacional, 41(5), 603–611.

[15] xºxSmarandache, F. (2025). Grados de pertenencia > 1 y < 0 de los elementos con respecto a un conjunto neutrosófico fuera de rango. Neutrosophic Computing and Machine Learning, 38, 60–67. ISSN 2574-1101. Retrieved from https://fs.unm.edu/NCML2/index.php/112/article/view/786

Received: December 31, 2024. Accepted: April 16, 2025.