Evaluating Priorities in the Implementation of Microcredentials in Latin American Universities through the Hierarchical Analytical Process for Educational Flexibility

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Abstract

This paper responds to the problem of establishing criteria priority for microcredential implementation in Latin American universities, a developing topic with great momentum and the need to professionalize traditional learning models. Amid rapid digital and labor developments, microcredentials emerge as an efficient way of certifying targeted skills and fostering adaptability to market demand. Still, implementation in higher education lacks a clear pathway of systematic substantiation. The state-of-the-art demonstrates that few mixed-method studies have attempted to prioritize institutional, pedagogical, and technological aspects of this endeavor. This paper applies the Analytic Hierarchy Process (AHP) to a criterion for criteria relative assessment as a method for qualitative and quantitative study. This approach assesses relative importance between seemingly equal criteria—digital infrastructure, teacher training, curriculum relevance, and external validity, for example—for better implementation within higher education systems. Results assess teacher training and platform interoperability as the two most important criteria for successful microcredential implementation. This study is relevant theoretically for multicriteria approaches to the assessment of learning flexibility and practically speaking, supports university administrative decisions for more adaptable, equity-driven and sustainable learning options.

Keywords: Microcredentials; Higher Education; AHP; Educational Flexibility; University Innovation; Prioritization, Latin America

1. Introduction

Microcredentials implementation in Latin American universities is a logical answer to an accelerated labor market and higher education transformations [1]. This research assesses the priorities of this implementation through the Analytic Hierarchy Process due to the need to make a once rigid model more flexible to avoid adjustments in demanded competences. They are significant because these certifications can certify certain skills in shorter spans of time, which enhances employability and social inclusion. As [2] found recently, 78% of employers value competencies proven by these certifications more than degrees. In addition, due to digitalization, requirements for transformation without compromising quality or equity emerge in institutions. Therefore, prioritizing the most important aspects for consistent investment makes sense. The region lacks systematic approaches about these matters, further justifying the need for this research. Thus, this work contributes to education with more dynamism and relevance. Finally, it aligns with global lifelong learning policies [3]. The subsequent multi-criteria methodology will enable decision making with both precision and strategic vision.

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Microcredentials emerged in the 2010s as an alternative to short-term training experiences with platforms like Coursera and edX [4]. Initially, microcredentials were associated with digital badges and subsequently transformed into modular certifications that count as recognized efforts as per certain institutions. In Latin America, however, microcredentials have been implemented on a smaller scale due to the digital divide and rigid regulatory frameworks. Since 2016, countries like Chile and Colombia have launched pilot programs but without scalability [5]. However, since 2016, the pandemic has changed the demand for such trainings and accelerated the search for flexible options; demonstrating traditional curricula increasingly belong to yesteryear. More than 1,000 active microcredential programs exist in Europe and North America, while Latin America only has sporadic implementations [6]. This shows that a certain structural inertia exists that avoids inter-institutional coordination. However, any such interest blossoms due to youth unemployment and job reconversion. Therefore, a need to prioritize solution exists. The Hierarchical Analytic Process emerges as the ideal assessment process to navigate such a reality.

How can strategic priorities be established for microcredential implementation in Latin American universities that lead to successful and sustainable educational flexibility? This question encompasses the evident gap that exists—there are no hierarchically established criteria that account for these projects from institutional, pedagogical or technological perspectives. There are isolated experiences across the region but no tool to systematically assess trained comparatives like infrastructure or teacher preparation or external reaccreditation needs that outweigh others. Furthermore, the region faces limitations due to platform compatibility and adherence to regional job markets [7]. The lack of definition in these matters results in resource scattering and low institutional buy-in. In addition, perceptions that microcredentials are a minor support option fails to recognize their game-changing capacity relative to traditional institutions. Therefore, without clarity in weight quantifiers, strategic policy interventions run the risk of focusing on solutions that maintain educational inequity. Hence, an assessment is needed that quantifies proper weights for strategic policymaking value. The question is not only technical but also fundamentally strategic. Therefore, this research seeks to answer the proposal with clarity and applicability.

The general objective is to assess the strategic priorities of microcredential implementation in Latin American universities through the Hierarchical Analytic Process for inclusive and sustainable educational flexibility. The specific objectives of this research are: (i) to assess and categorize criteria relative to institutional implementation priorities; (ii) to gauge assessments via comparative pairs for relative weighting; (iii) to validate findings with experts within the regional education sector; and (iv) to present findings in a hierarchical structure applicable elsewhere in similar university settings. These objectives answer the research question directly while connecting theoretical and practical elements. Furthermore, they provide a roadmap for potential decision makers on microcredential topics. The multifactorial approach provides analytical credibility. Finally, this research seeks to connect educated innovations with Latin American realities. Thus, it will serve as a reference for future curricular flexibility endeavors.

2. Related Works.

2.1. **Microcredentials in Universities**

Latin American universities grapple with microcredential implementation as a necessity to meet a rapidly evolving labor market [8]. These short, modular certifications validate disaggregated skills and talents and fill the gaps associated with conventional offerings. Their strength lies in curricular flexibility and alignment with new demands from different sectors, yet institutions remain in a piecemeal fashion as no strategic guidelines are established. Moreover, inconsistent digital landscapes across countries create obstacles for large-scale rollout. Thus, funding needs to be addressed so universities do not develop niche offerings without systemic impact. At the same time, microcredentials development occurs with teacher training as a fundamental pillar. Thus, universities redirect resources to digital pedagogical training. Thus, through microcredentialing, offerings are joined and transformed. This creates increased equity and academic relevance.

Platform interoperability is a critical factor in successful microcredential implementation. Independent platforms generate unidentifiable credentials that offer little value to employers [9]. Thus, standardized formats and validation measures are required. Europe's leading universities have implemented the use of blockchain for traceability and reliability while Latin America lacks common standards for interoperable developments. This technological divide maintains inequity in skills recognition across regions. Moreover, without national policies, fragmentation exists between institutions. However, pilot measures in Mexico and Brazil are steppingstones. In short, technological application must occur before large-scale rollout. In doing so, credential portability and credibility are established.

External endorsement from companies and regulatory agencies represents the ultimate success of microcredentialing. Without the backing of the workforce, credentials lose validity in purpose [10]. Thus, universities must create strategic partnerships with the productive sector that allow for specific market needs for design and

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immediate workforce reintegration upon graduation. In Australia, companies themselves directly back over 70% of microcredentials; however, in Latin America, academic-business gaps exist that reduce graduates' employability. Thus, public-private networks must be created so that microcredentials possess legitimacy and tangible application.

Curricular relevance poses a critical pedagogical challenge to microcredential integration. Constantly evolving educational content must account for technological growth and professional developments [11]. However, conventional curriculum development processes for accreditation are slow and bureaucratic. The lack of agility creates resistance to immediate environmental changes. Furthermore, faculty apprehension regarding curricular revamping stands as an obstacle to renewal. Therefore, agile instructional design approaches need to be implemented to accommodate design-of-relevance. The University of Chile has created specialized microlearning units. These new structures employ rapid developments of relevant offerings. Ultimately, pedagogical flexibility maintains valid criteria for such offerings to operate within constantly shifting environments.

Teacher training stands as the most important facilitator for the success of microcredentials. Teachers lacking digital literacy will be unable to implement successful modular offerings [12]. Thus, important resources must be dedicated to continual professional development opportunities. Training programs that include microcourse creation and competency-based assessments exist where teacher volition plays a significant role in how quality offerings come into fruition. In Canada, 85% of teachers receive specific training for microcredentials; however, in most Latin American nations, such training is minimal at best. This approach promotes a hybridization in potential success where implementation falls short of transformative possibilities. Thus, universities need to rearrange their academic development expectations regarding teacher training for a pedagogically sound implementation.

Digital infrastructure creates a solid technical foundation upon which universities can implement microcredentials where learning platforms can facilitate successful management [8]. Many institutions do not have integrated management systems for academics that support digital certificate implementation and verification. At the same time, uneven access to digital connectivity exacerbates rural alienation from urban offerings—thus requiring resources to increase access to cloud Computing or specialized LMS. Universities like the National University of Colombia made a successful transition to digitalization. These patterns show that while an initial investment may seem excessive, medium-term returns contribute value. In short, technological foundations support every component related to microcredentials. This builds institutional scale.

The institutional governance model for which microcredentials exist highly influences their sustainability. Conventional hierarchies impede educational change [9]. It is advisable to develop specific units related to microcredential offerings, which coordinate design, evaluation, and strategic agency partnerships with efficient decision-making possibilities that are both agile and transversal in direction. In Spain, continuing education centers have connected this transition; however, in Latin America, responsibility dispersion reigns supreme where overlaps exist without coherent thinking bringing ideas together. Thus, university organigrams must be redesigned so that microcredentials are holistically integrated into institutional ecosystems.

Impact measurement renders accountability according to job placement rates and employer satisfaction [10]. Many colleges fail to longitudinally assess their modular graduates to determine offering adaptation based on real factors provided by validated numbers. Furthermore, the lack of standardized criteria complicates inter-institutional considerations for offer quality assessment. Therefore, employability observatories must be established that found in the United Kingdom with great success providing real improvement for educational offerings. The University of Buenos Aires has created a successful model following this logic in the region. Ultimately, constant measurement brings things back to equity considerations, which render new developments based on measured evidence.

Social inclusion represents one of the greatest ethical transformations that university microcredentials can achieve [11]. They democratize access to higher education by better designing vulnerable population-based offerings that include scholarships, asynchronous formats, and acknowledgment of prior experiences relative to learning through access problems (asynchronous credits). On the other hand, women who work and single mothers require flexible schedules; thus, where Finland boasts better gender parity due to microcredentials, economic and digital disparities plague Latin America at present. This demands specific equity policies where universities take a forefront role so that microcredentials realize their promises through social transformation.

Financial sustainability represents long-term viability for microcredentials. Self-financing and corporate investment models are viable [12]. Yet without additional public funding for expansion efforts are limited. Strategic equity comes from diversified funding streams through direct partnerships with companies that co-finance otherwise expensive programs with win/win outcomes. Thus offering increased numbers accessible since Singapore tripled these efforts. In the region, Federico Santa María Technical University has exemplified this

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productivity where financial planning renders institutional permanence feasible as resources stabilize equity efforts over years or decades.

2.2. Neutrosophic Set.

Neutrosophic sets constitute a new approach to set theory by forgoing the true/false binary of traditional logic and adding a third element: the indeterminacy. Defined by Florentin Smarandache, this theory claims that a set can be true and false or, most importantly, indeterminate with no precise clarity regarding its truth. This three-part approach—, which operates like a 33%/33%/34%—represents the ambiguities we often experience when investigating real-world phenomena and where the lines between true and false are not clearly delineated. Mathematically and philosophically, they effectively represent uncertainty. Furthermore, in contrast to fuzzy sets, which compile levels of membership, or intercalary sets—, which use intervals, neutrosophic sets embrace the innate uncertainty of human reasoning. By formalizing this uncertainty, the theoretical set expands proven fields but has applications in artificial intelligence, where imprecise logic enhances data processing and automated reasoning when faced with insufficient information.

Empirically, one of the most significant impacts of neutrosophic sets is how they render reality more plausible. When a universal truth cannot exist—like a medical diagnosis reliant on interpretation or fragmented knowledge—this three-part model better absorbs the complexities of reality. The world is not often black and white but instead shades of grey—and neutrosophic sets embrace uncertainty instead of shying away from it. Moreover, theorizing how best to apply neutrosophic sets deems philosophical significance; how can we define truth when certainty does not exist? How do we mediate uncertainty? These challenges force us to reconsider human limitations to solve a world increasingly complicated. Yet critiques of neutrosophic sets assert that indeterminate aspects add senseless layers to set theory. This challenge dismisses the ability of neutrosophic sets to better model uncertain phenomena naturally. They do not simplify realities but instead provide a powerful analytical tool for observation and investigation in their full potentiality. In practical application, especially the high-tech world of AI, neutrosophic sets would improve approaches by representing uncertainty better, transforming data and automated decision-making in more adaptable, robust frameworks.

Overall, neutrosophic sets position a crucial analysis to set theory by solving the challenges posed by binary logic. Their perspective has multidisciplinary implications to join theoretical mathematics and philosophy for a better study of uncertainty for decision-making and knowledge representation. Ultimately, an interdisciplinary integration could provide more adaptable frameworks that document not only reality but also how we fail to understand it.

Definition 1 ([13-15]) : The *neutrosophic set N* It is characterized by three membership functions, which are the truth membership function T_A, the indeterminacy membership functionI_A and falsity membership function F_A, where U is the Universe of Discourse and $\forall x \in U$, $T_A(x), I_A(x), F_A(x) \subseteq]\bar{_A}0, 1^+[$, and $\bar{_A}0 \leq \inf T_A(x) + \inf I_A(x) + \inf F_A(x) \leq \sup T_A(x) + \sup I_A(x) + \sup F_A(x) \leq 3^+$.

Note that, by definition, $T_A(x), I_A(x)$and $F_A(x)$are standard or nonstandard real subsets of $]\bar{_A}0, 1^+[$and, therefore, $T_A(x), I_A(x)$and $F_A(x)$can be subintervals. of $[0, 1]$. $\bar{_A}0$and1^+ They belong to the set of hyperreal numbers.

Definition 2 ([13-15] : The *single*- valued neutrosophic set *(* SVN S) $A$is U, $T_A: U \rightarrow [0,1]$where $A = \{< x, T_A(x), I_A(x), F_A(x) > : x \in U\}$and $I_A: U \rightarrow [0,1]$. $F_A: U \rightarrow [0,1]$.$0 \leq T_A(x) + I_A(x) + F_A(x) \leq 3$

The single-valued neutrosophic number (SVN) N) is symbolized by

$N = (t, i, f)$, so that$0 \leq t, i, f \leq 1$ and $0 \leq t + i + f \leq 3$.

Definition 3 ([13-15]) : The *single- valued triangular neutrosophic number* , $\tilde{a} = \langle (a_1, a_2. a_3); \alpha_{\tilde{a}}, \beta_{\tilde{a}}, \gamma_{\tilde{a}} \rangle$, is a neutrosophic set in $\mathbb{R}$, whose truth, indeterminacy and falsity membership functions are defined as follows:

$$T_{\tilde{a}}(x) = \begin{cases} \alpha_{\tilde{a}}\left(\frac{x-a_1}{a_2-a_1}\right), a_1 \leq x \leq a_2 \\ \alpha_{\tilde{a}}, x = a_2 \\ \alpha_{\tilde{a}}\left(\frac{a_3-x}{a_3-a_2}\right), a_2 < x \leq a_3 \\ 0, \text{otherwise} \end{cases} \quad (1)$$

$$I_{\tilde{a}}(x) = \begin{cases} \frac{(a_2 - x + \beta_{\tilde{a}}(x-a_1))}{a_2-a_1}, a_1 \leq x \leq a_2 \\ \beta_{\tilde{a}}, x = a_2 \\ \frac{(x - a_2 + \beta_{\tilde{a}}(a_3-x))}{a_3-a_2}, a_2 < x \leq a_3 \\ 1, \text{otherwise} \end{cases} \quad (2)$$

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$$F_{\tilde{a}}(x) = \begin{cases} \frac{(a_2 - x + \gamma_{\tilde{a}}(x - a_1))}{a_2 - a_1}, a_1 \leq x \leq a_2 \\ \gamma_{\tilde{a},} x = a_2 \\ \frac{(x - a_2 + \gamma_{\tilde{a}}(a_3 - x))}{a_3 - a_2}, \ a_2 < x \leq a_3 \\ 1, \text{otherwise} \end{cases} \quad (3)$$

Where $\alpha_{\tilde{a}}, \beta_{\tilde{a}}, \gamma_{\tilde{a}} \in [0, 1]$,$a_1$, $a_2, a_3 \in \mathbb{R}$ and $a_1 \leq a_2 \leq a_3$.

Definition 4 ([13- 15]) : Given$\tilde{a} = \langle (a_1, a_2, a_3); \alpha_{\tilde{a}}, \beta_{\tilde{a}}, \gamma_{\tilde{a}} \rangle$ and$\tilde{b} = \langle (b_1, b_2, b_3); \alpha_{\tilde{b}}, \beta_{\tilde{b}}, \gamma_{\tilde{b}} \rangle$ two single-valued triangular neutrosophic numbers andλ Any nonzero number on the real number line. The following operations are defined:

1. Addition: $\tilde{a} + \tilde{b} = \langle (a_1 + b_1, a_2 + b_2, a_3 + b_3); \alpha_{\tilde{a}} \wedge \alpha_{\tilde{b}}, \beta_{\tilde{a}} \vee \beta_{\tilde{b}}, \gamma_{\tilde{a}} \vee \gamma_{\tilde{b}} \rangle$,

2. Subtraction: $\tilde{a} - \tilde{b} = \langle (a_1 - b_3, a_2 - b_2, a_3 - b_1); \alpha_{\tilde{a}} \wedge \alpha_{\tilde{b}}, \beta_{\tilde{a}} \vee \beta_{\tilde{b}}, \gamma_{\tilde{a}} \vee \gamma_{\tilde{b}} \rangle$,

3. Investment : $\tilde{a}^{-1} = \langle ({a_3}^{-1}, {a_2}^{-1}, {a_1}^{-1}); \alpha_{\tilde{a}}, \beta_{\tilde{a}}, \gamma_{\tilde{a}} \rangle$, where $a_1, a_2, a_3 \neq 0$.

4. Multiplication by a scalar number:

$$\lambda\tilde{a} = \begin{cases} \langle (\lambda a_1, \lambda a_2, \lambda a_3); \alpha_{\tilde{a}}, \beta_{\tilde{a}}, \gamma_{\tilde{a}} \rangle, \lambda > 0 \\ \langle (\lambda a_3, \lambda a_2, \lambda a_1); \alpha_{\tilde{a}}, \beta_{\tilde{a}}, \gamma_{\tilde{a}} \rangle, \lambda < 0 \end{cases}$$

5. Division of two triangular neutrosophic numbers:

$$\frac{\tilde{a}}{\tilde{b}} = \begin{cases} \langle \left(\frac{a_1}{b_3}, \frac{a_2}{b_2}, \frac{a_3}{b_1}\right); \alpha_{\tilde{a}} \wedge \alpha_{\tilde{b}}, \beta_{\tilde{a}} \vee \beta_{\tilde{b}}, \gamma_{\tilde{a}} \vee \gamma_{\tilde{b}} \rangle, a_3 > 0 \text{ and } b_3 > 0 \\ \langle \left(\frac{a_3}{b_3}, \frac{a_2}{b_2}, \frac{a_1}{b_1}\right); \alpha_{\tilde{a}} \wedge \alpha_{\tilde{b}}, \beta_{\tilde{a}} \vee \beta_{\tilde{b}}, \gamma_{\tilde{a}} \vee \gamma_{\tilde{b}} \rangle, a_3 < 0 \text{ and } b_3 > 0 \\ \langle \left(\frac{a_3}{b_1}, \frac{a_2}{b_2}, \frac{a_1}{b_3}\right); \alpha_{\tilde{a}} \wedge \alpha_{\tilde{b}}, \beta_{\tilde{a}} \vee \beta_{\tilde{b}}, \gamma_{\tilde{a}} \vee \gamma_{\tilde{b}} \rangle, a_3 < 0 \text{ and } b_3 < 0 \end{cases}$$

6. Multiplication of two triangular neutrosophic numbers:

$$\tilde{a}\tilde{b} = \begin{cases} \langle (a_1 b_1, a_2 b_2, a_3 b_3); \alpha_{\tilde{a}} \wedge \alpha_{\tilde{b}}, \beta_{\tilde{a}} \vee \beta_{\tilde{b}}, \gamma_{\tilde{a}} \vee \gamma_{\tilde{b}} \rangle, \ a_3 > 0 \text{ and } b_3 > 0 \\ \langle (a_1 b_3, a_2 b_2, a_3 b_1); \alpha_{\tilde{a}} \wedge \alpha_{\tilde{b}}, \beta_{\tilde{a}} \vee \beta_{\tilde{b}}, \gamma_{\tilde{a}} \vee \gamma_{\tilde{b}} \rangle, a_3 < 0 \text{ and } b_3 > 0 \\ \langle (a_3 b_3, a_2 b_2, a_1 b_1); \alpha_{\tilde{a}} \wedge \alpha_{\tilde{b}}, \beta_{\tilde{a}} \vee \beta_{\tilde{b}}, \gamma_{\tilde{a}} \vee \gamma_{\tilde{b}} \rangle, a_3 < 0 \text{ and } b_3 < 0 \end{cases}$$

Where,$\wedge$ It is a rule$\vee$ It is a conorm t.

The AHP technique begins with the designation of a hierarchical structure, where the elements at the top of the tree are more generic than those at lower levels do. The main leaf is unique and denotes the objective to be achieved in decision-making.

The next level down contains the sheets representing the criteria. The sheets corresponding to the subcriteria appear immediately below this level, and so on. The next level down represents the alternatives. See Figure 1.

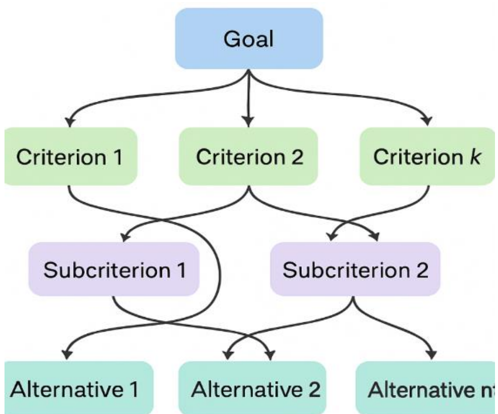

Figure 1. Generic tree diagram representing a hierarchical analytical process. Source: [16].

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A square matrix is then formed that represents the opinion of the expert or experts and contains the pairwise comparison of the assessments of the criteria, subcriteria and alternatives.

TL Saaty, the founder of the original method, proposed a linguistic scale that appears in Table 1.

Table 1: Intensity of importance according to the classic AHP. Source [16-19].

Intensity of importance on an absolute scale	**Definition**	**Explanation**
1	Equal importance	Two activities contribute equally to the objective.
3	Moderate importance of one over the other	Experience and judgment strongly favor one activity over another.
5	Essential or strong importance	Experience and judgment strongly favor one activity over another.
7	very strong importance	The activity is strongly encouraged and its mastery is demonstrated in practice.
9	Very important	The evidence that favors one activity over another is of the highest order of affirmation possible.
2, 4, 6, 8	Intermediate values between the two adjacent statements.	When understanding is needed
Reciprocals	If activity *i* has one of the above numbers assigned compared to activity *j* , then *j* has the reciprocal value compared to *i* .	

On the other hand, Saaty established that the *Consistency Index* (CI) should depend on λ_{max} , the maximum eigenvalue of the matrix. He defined the equation $CI = \frac{\lambda_{max}-n}{n-1}$, where n is the order of the matrix. He also defined the *Consistency Index* (CI) with the equation CI = IC/RI, where RI is shown in Table 2 .

Table 2: RI associated with each order

Order (n)	1	2	3	4	5	6	7	8	9	10
Rhode Island	0	0	0.52	0.89	1.11	1.25	1.35	1.40	1.45	1.49

If $CR \leq 10\%$we can consider that, the experts' assessment is sufficiently consistent and therefore we can proceed to use AHP.

The objective of the AHP is to rank criteria, subcriteria, and alternatives based on a score. It can also be used in-group decision-making problems. To do this, consider equations 4 and 5, which evaluate the expert's weighting based on their authority, knowledge, experience, etc.

$$\bar{x} = \left(\prod_{i=1}^{n} x_i^{w_i}\right)^{1/\sum_{i=1}^{n} w_i} (4)$$

If $\sum_{i=1}^{n} w_i = 1$, that is, when the experts' weights sum to one, equation 4 becomes equation 5,

$$\bar{x} = \prod_{i=1}^{n} x_i^{w_i} (5)$$

Hybridization of AHP with neutrosophic set theory was used in [16] . This is a more flexible approach to model uncertainty in decision making . Indeterminacy is an essential component that must be assumed in real-world organizational decisions.

Table 3 contains the adaptation of the Saaty scale to the neutrosophic field.

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Table 3: The Saaty scale was translated into a neutrosophic triangular scale. Source [16].

scale saty	Definition	Neutrosophic triangular scale
1	Equally influential	$\tilde{1} = \langle(1,1,1); 0.50, 0.50, 0.50\rangle$
3	Slightly influential	$\tilde{3} = \langle(2,3,4); 0.30, 0.75, 0.70\rangle$
5	Strongly influential	$\tilde{5} = \langle(4,5,6); 0.80, 0.15, 0.20\rangle$
7	Very influential	$\tilde{7} = \langle(6,7,8); 0.90, 0.10, 0.10\rangle$
9	Absolutely influential	$\tilde{9} = \langle(9,9,9); 1.00, 1.00, 1.00\rangle$
2, 4, 6, 8	Sporadic values between two close scales	$\tilde{2} = \langle(1,2,3); 0.40, 0.65, 0.60\rangle$
		$\tilde{4} = \langle(3,4,5); 0.60, 0.35, 0.40\rangle$
		$\tilde{6} = \langle(5,6,7); 0.70, 0.25, 0.30\rangle$
		$\tilde{8} = \langle(7,8,9); 0.85, 0.10, 0.15\rangle$

The pairwise neutrosophic comparison matrix is defined in equation 6 .

$$\widetilde{A} = \begin{bmatrix} \tilde{1} & \tilde{a}_{12} & \cdots & \tilde{a}_{1n} \\ \vdots & & \ddots & \vdots \\ \tilde{a}_{n1} & \tilde{a}_{n2} & \cdots & \tilde{1} \end{bmatrix} \quad (6)$$

$\widetilde{A}$ satisfies the condition $\tilde{a}_{ji} = \tilde{a}_{ij}^{-1}$, according to the inversion operator defined in Definition 4 .

in Abdel-Basset et al. [20]. See Equation 7 for the *score* and Equation 8 for *the precision* .

$$S(\tilde{a}) = \frac{1}{8}[a_1 + a_2 + a_3](2 + \alpha_{\tilde{a}} - \beta_{\tilde{a}} - \gamma_{\tilde{a}}) (7)$$

$$A(\tilde{a}) = \frac{1}{8}[a_1 + a_2 + a_3](2 + \alpha_{\tilde{a}} - \beta_{\tilde{a}} + \gamma_{\tilde{a}}) (8)$$

The algorithm to be applied to the NAHP is as follows:

Given the criteria, subcriteria and alternatives, the NAHP consists of the following steps:

1. Design an AHP tree. This tree contains the selected criteria, subcriteria , and alternatives .

2. Create the level matrices from the AHP tree, according to expert criteria expressed in neutrosophic triangular scales and respecting the matrix scheme of Equation 6.

3. To evaluate the consistency of these matrices , convert the elements of $\widetilde{A}$ into a crisp matrix by applying equation 7 or 8 and then testing the consistency of this new crisp matrix .

4. Follow the other steps of a classic AHP.

5. Equation 7 or 8 is applied to convert $w_1, w_2, \ldots, w_n$ into crisp weights.

6. If more than one expert performs the assessment, then $w_1, w_2, \ldots, w_n$ are replaced by $\overline{w}_1, \overline{w}_2, \cdots, \overline{w}_n$, which are their corresponding weighted geometric mean values, see equations 4 and 5 .

3. Results

As part of a research project for the "Evaluation of Priorities in Microcredential Implementation in Latin American Universities," the Neutrosophic Analytic Hierarchy Process (NAHP) was applied to make educational models more flexible. The objective is to identify and prioritize critical strategic factors that influence the successful adoption of a microcredential system .

To achieve this, a panel of four experts in educational policy, curriculum management, educational technology, and university accreditation in the Latin American context was consulted. Each expert was selected for their extensive experience. They were asked to evaluate a set of seven implementation criteria (ICs), identified as determinants of project success, assigning equal weight to each expert's opinion.

Implementation Criteria Evaluated

The strategic criteria evaluated for the adoption of microcredentials were:

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- **MC1 (Technological Infrastructure and Platforms):** Costs and challenges associated with the acquisition, development and interoperability of the digital platforms necessary to issue, verify and manage microcredentials .
- **MC2 (Teacher Training and Pedagogical Change):** The need to train teachers in competency design, flexible assessment methodologies, and the shift from a traditional to a modular teaching culture.
- **MC3 (Quality Assurance and Assessment):** The complexity of establishing robust mechanisms to ensure academic rigor, the validity of assessments, and the credibility of certified competencies.
- **MC4 (External Recognition and Employability):** Uncertainty about how the labor market and other educational institutions will value and accept these new credentials as valid proof of skills.
- **MC5 (Curricular Integration and Internal Recognition):** Difficulty aligning microcredentials with existing curricula (credits, curricula) and getting them formally recognized by the institution itself.
- **MC6 (Regulatory Alignment and Accreditation):** The need to adapt internal regulations and comply with the standards of national accreditation agencies, which are often not prepared for curricular flexibility.
- **MC7 (Student Demand and Accessibility):** Concerns about whether students (end users) will perceive the value of microcredentials and whether the systems will be accessible to all.

Application of the NAHP Algorithm

The steps of the Neutrosophic Analytic Hierarchy Process (NAHP) were followed to obtain a robust classification of the criteria.

Steps 1 and 2: AHP Hierarchy and Neutrosophic Comparison Matrices

Microcredential Implementation Criteria) and the seven criteria (MC1 to MC7) at the bottom. Each of the four experts performed a paired comparison of the criteria using the neutrosophic triangular scale. This resulted in the four comparison matrices shown below (Tables 4-7).

Table 4: Neutrosophic pairwise comparison matrix - Expert 1

Variable	MC1	MC2	MC3	MC4	MC5	MC6	MC7
MC1	(1,1,1; 0.5,0.5,0.5)	(1/3,1/2,1; 0.4,0.65,0.6)	(1/4,1/3,1/2; 0.3,0.75,0.7)	(1/4,1/3,1/2; 0.3,0.75,0.7)	(1/4,1/3,1/2; 0.3,0.75,0.7)	(1/4,1/3,1/2; 0.3,0.75,0.7)	(1/3,1/2,1; 0.4,0.65,0.6)
MC2	(1,2,3; 0.4,0.65,0.6)	(1,1,1; 0.5,0.5,0.5)	(1,2,3; 0.4,0.65,0.6)	(1/3,1/2,1; 0.4,0.65,0.6)	(1/3,1/2,1; 0.4,0.65,0.6)	(1,1,1; 0.5,0.5,0.5)	(1/4,1/3,1/2; 0.3,0.75,0.7)
MC3	(2,3,4; 0.3,0.75,0.7)	(1,1,1; 0.5,0.5,0.5)	(1,1,1; 0.5,0.5,0.5)	(1,1,1; 0.5,0.5,0.5)	(1/4,1/3,1/2; 0.3,0.75,0.7)	(1,1,1; 0.5,0.5,0.5)	(1,2,3; 0.4,0.65,0.6)
MC4	(2,3,4; 0.3,0.75,0.7)	(1,2,3; 0.4,0.65,0.6)	(1,1,1; 0.5,0.5,0.5)	(1,1,1; 0.5,0.5,0.5)	(1,1,1; 0.5,0.5,0.5)	(1,1,1; 0.5,0.5,0.5)	(1/4,1/3,1/2; 0.3,0.75,0.7)
MC5	(2,3,4; 0.3,0.75,0.7)	(1,2,3; 0.4,0.65,0.6)	(2,3,4; 0.3,0.75,0.7)	(1,1,1; 0.5,0.5,0.5)	(1,1,1; 0.5,0.5,0.5)	(1,2,3; 0.4,0.65,0.6)	(1,1,1; 0.5,0.5,0.5)
MC6	(2,3,4; 0.3,0.75,0.7)	(1,1,1; 0.5,0.5,0.5)	(1,1,1; 0.5,0.5,0.5)	(1,1,1; 0.5,0.5,0.5)	(1/3,1/2,1; 0.4,0.65,0.6)	(1,1,1; 0.5,0.5,0.5)	(1,2,3; 0.4,0.65,0.6)
MC7	(1,2,3; 0.4,0.65,0.6)	(2,3,4; 0.3,0.75,0.7)	(1/3,1/2,1; 0.4,0.65,0.6)	(2,3,4; 0.3,0.75,0.7)	(1,1,1; 0.5,0.5,0.5)	(1/3,1/2,1; 0.4,0.65,0.6)	(1,1,1; 0.5,0.5,0.5)

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Table 5: Neutrosophic pairwise comparison matrix - Expert 2

Variable	MC1	MC2	MC3	MC4	MC5	MC6	MC7
MC1	(1,1,1; 0.5,0.5,0.5)	(1/4,1/3,1/2; 0.3,0.75,0.7)	(1/4,1/3,1/2; 0.3,0.75,0.7)	(1/3,1/2,1; 0.4,0.65,0.6)	(1/3,1/2,1; 0.4,0.65,0.6)	(1/4,1/3,1/2; 0.3,0.75,0.7)	(1/4,1/3,1/2; 0.3,0.75,0.7)
MC2	(2,3,4; 0.3,0.75,0.7)	(1,1,1; 0.5,0.5,0.5)	(1,1,1; 0.5,0.5,0.5)	(1/4,1/3,1/2; 0.3,0.75,0.7)	(1/3,1/2,1; 0.4,0.65,0.6)	(1,2,3; 0.4,0.65,0.6)	(1/3,1/2,1; 0.4,0.65,0.6)
MC3	(2,3,4; 0.3,0.75,0.7)	(1,1,1; 0.5,0.5,0.5)	(1,1,1; 0.5,0.5,0.5)	(1,2,3; 0.4,0.65,0.6)	(1,1,1; 0.5,0.5,0.5)	(1/4,1/3,1/2; 0.3,0.75,0.7)	(1,1,1; 0.5,0.5,0.5)
MC4	(1,2,3; 0.4,0.65,0.6)	(2,3,4; 0.3,0.75,0.7)	(1/3,1/2,1; 0.4,0.65,0.6)	(1,1,1; 0.5,0.5,0.5)	(1,1,1; 0.5,0.5,0.5)	(1/3,1/2,1; 0.4,0.65,0.6)	(1,2,3; 0.4,0.65,0.6)
MC5	(1,2,3; 0.4,0.65,0.6)	(1,2,3; 0.4,0.65,0.6)	(1,1,1; 0.5,0.5,0.5)	(1,1,1; 0.5,0.5,0.5)	(1,1,1; 0.5,0.5,0.5)	(1,1,1; 0.5,0.5,0.5)	(1,1,1; 0.5,0.5,0.5)
MC6	(2,3,4; 0.3,0.75,0.7)	(1/3,1/2,1; 0.4,0.65,0.6)	(2,3,4; 0.3,0.75,0.7)	(1,2,3; 0.4,0.65,0.6)	(1,1,1; 0.5,0.5,0.5)	(1,1,1; 0.5,0.5,0.5)	(1,1,1; 0.5,0.5,0.5)
MC7	(2,3,4; 0.3,0.75,0.7)	(1,2,3; 0.4,0.65,0.6)	(1,1,1; 0.5,0.5,0.5)	(1/3,1/2,1; 0.4,0.65,0.6)	(1,1,1; 0.5,0.5,0.5)	(1,1,1; 0.5,0.5,0.5)	(1,1,1; 0.5,0.5,0.5)

Table 6: Neutrosophic pairwise comparison matrix - Expert 3

Variable	MC1	MC2	MC3	MC4	MC5	MC6	MC7
MC1	(1,1,1; 0.5,0.5,0.5)	(1/4,1/3,1/2; 0.3,0.75,0.7)	(1/3,1/2,1; 0.4,0.65,0.6)	(1/3,1/2,1; 0.4,0.65,0.6)	(1/4,1/3,1/2; 0.3,0.75,0.7)	(1/4,1/3,1/2; 0.3,0.75,0.7)	(1,1,1; 0.5,0.5,0.5)
MC2	(2,3,4; 0.3,0.75,0.7)	(1,1,1; 0.5,0.5,0.5)	(1/4,1/3,1/2; 0.3,0.75,0.7)	(1/3,1/2,1; 0.4,0.65,0.6)	(1,2,3; 0.4,0.65,0.6)	(1/3,1/2,1; 0.4,0.65,0.6)	(1/3,1/2,1; 0.4,0.65,0.6)
MC3	(1,2,3; 0.4,0.65,0.6)	(2,3,4; 0.3,0.75,0.7)	(1,1,1; 0.5,0.5,0.5)	(1,1,1; 0.5,0.5,0.5)	(1/4,1/3,1/2; 0.3,0.75,0.7)	(1,1,1; 0.5,0.5,0.5)	(1,1,1; 0.5,0.5,0.5)
MC4	(1,2,3; 0.4,0.65,0.6)	(1,2,3; 0.4,0.65,0.6)	(2,3,4; 0.3,0.75,0.7)	(1,1,1; 0.5,0.5,0.5)	(1/3,1/2,1; 0.4,0.65,0.6)	(1,2,3; 0.4,0.65,0.6)	(1,2,3; 0.4,0.65,0.6)
MC5	(2,3,4; 0.3,0.75,0.7)	(1/3,1/2,1; 0.4,0.65,0.6)	(2,3,4; 0.3,0.75,0.7)	(1,2,3; 0.4,0.65,0.6)	(1,1,1; 0.5,0.5,0.5)	(1,1,1; 0.5,0.5,0.5)	(1,1,1; 0.5,0.5,0.5)
MC6	(2,3,4; 0.3,0.75,0.7)	(1,2,3; 0.4,0.65,0.6)	(1/3,1/2,1; 0.4,0.65,0.6)	(1/3,1/2,1; 0.4,0.65,0.6)	(1,1,1; 0.5,0.5,0.5)	(1,1,1; 0.5,0.5,0.5)	(1,2,3; 0.4,0.65,0.6)
MC7	(1,1,1; 0.5,0.5,0.5)	(1,2,3; 0.4,0.65,0.6)	(1,1,1; 0.5,0.5,0.5)	(1/3,1/2,1; 0.4,0.65,0.6)	(1,1,1; 0.5,0.5,0.5)	(1/3,1/2,1; 0.4,0.65,0.6)	(1,1,1; 0.5,0.5,0.5)

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Table 7: Neutrosophic pairwise comparison matrix - Expert 4

Variable	MC1	MC2	MC3	MC4	MC5	MC6	MC7
MC1	(1,1,1; 0.5,0.5,0.5)	(1/3,1/2,1; 0.4,0.65,0.6)	(1/4,1/3,1/2; 0.3,0.75,0.7)	(1/4,1/3,1/2; 0.3,0.75,0.7)	(1/4,1/3,1/2; 0.3,0.75,0.7)	(1/4,1/3,1/2; 0.3,0.75,0.7)	(1/3,1/2,1; 0.4,0.65,0.6)
MC2	(1,2,3; 0.4,0.65,0.6)	(1,1,1; 0.5,0.5,0.5)	(1,2,3; 0.4,0.65,0.6)	(1/3,1/2,1; 0.4,0.65,0.6)	(1/3,1/2,1; 0.4,0.65,0.6)	(1,1,1; 0.5,0.5,0.5)	(1/3,1/2,1; 0.4,0.65,0.6)
MC3	(2,3,4; 0.3,0.75,0.7)	(1/3,1/2,1; 0.4,0.65,0.6)	(1,1,1; 0.5,0.5,0.5)	(1,1,1; 0.5,0.5,0.5)	(1/4,1/3,1/2; 0.3,0.75,0.7)	(1,1,1; 0.5,0.5,0.5)	(1,1,1; 0.5,0.5,0.5)
MC4	(2,3,4; 0.3,0.75,0.7)	(1,2,3; 0.4,0.65,0.6)	(1,2,3; 0.4,0.65,0.6)	(1,1,1; 0.5,0.5,0.5)	(1,1,1; 0.5,0.5,0.5)	(1,1,1; 0.5,0.5,0.5)	(1,1,1; 0.5,0.5,0.5)
MC5	(2,3,4; 0.3,0.75,0.7)	(2,3,4; 0.3,0.75,0.7)	(2,3,4; 0.3,0.75,0.7)	(1,1,1; 0.5,0.5,0.5)	(1,1,1; 0.5,0.5,0.5)	(1,2,3; 0.4,0.65,0.6)	(1/4,1/3,1/2; 0.3,0.75,0.7)
MC6	(1,2,3; 0.4,0.65,0.6)	(1,2,3; 0.4,0.65,0.6)	(1/3,1/2,1; 0.4,0.65,0.6)	(1,1,1; 0.5,0.5,0.5)	(1/3,1/2,1; 0.4,0.65,0.6)	(1,1,1; 0.5,0.5,0.5)	(1/3,1/2,1; 0.4,0.65,0.6)
MC7	(1,2,3; 0.4,0.65,0.6)	(1,2,3; 0.4,0.65,0.6)	(1,1,1; 0.5,0.5,0.5)	(1,1,1; 0.5,0.5,0.5)	(2,3,4; 0.3,0.75,0.7)	(1,2,3; 0.4,0.65,0.6)	(1,1,1; 0.5,0.5,0.5)

Step 3: Consistency Check

The neutrosophic matrices were converted to crisp matrices (using Equation 7) to assess their consistency. Consistency ratios (CRs) were calculated for each expert's assessment, using the Random Index (RI) for n = 7, which is RI = 1.35.

- Expert 1: CR < 0.10
- Expert 2: CR < 0.10
- Expert 3: CR < 0.10
- Expert 4: CR < 0.10

Since all CR values were below the 10% threshold (0.10), it is concluded that the four experts' judgments are consistent and reliable. Therefore, the next steps of the analysis can be continued.

Steps 4 and 5: Calculating Individual Weights and Aggregation

From the consistent matrices, weighting vectors (priorities) were calculated for each criterion, based on each expert's assessment. These weights (obtained after converting to a crisp matrix and calculating the eigenvector) are presented in the following table:

Table 8: Weights obtained for each variable by expert

Expert/Variable	MC1	MC2	MC3	MC4	MC5	MC6	MC7
1	0.178070	0.178070	0.122520	0.122520	0.134730	0.112040	0.112040
2	0.225817	0.142051	0.082832	0.142051	0.154348	0.126451	0.126451
3	0.101632	0.181524	0.078080	0.078080	0.181524	0.157636	0.181524
4	0.162187	0.162187	0.162187	0.162187	0.162187	0.074533	0.074533

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To consolidate the four experts' assessments into a single final weighting vector, the weighted geometric mean is applied. Since all experts have the same weighting, ($\lambda_k = 0.25$),the formula for each criterion j is:

$$w_j = \left(\prod_{k=1}^{4} w_{jk}\right)^{\frac{1}{4}}$$

Below are the detailed calculations for each criterion (maintaining 6 decimal places of precision in the intermediate steps):

Geometric Mean Calculations

- **Calculation for MC1 (Technological Infrastructure):**

$$w_{MC1} = (0.178070 \times 0.225817 \times 0.101632 \times 0.162187)^{\frac{1}{4}}$$

$$w_{MC1} = (0.00066277)^{\frac{1}{4}} = 0.160416$$

- **Calculation for MC2 (Teacher Training):**

$$w_{MC2} = (0.178070 \times 0.142051 \times 0.181524 \times 0.162187)^{\frac{1}{4}}$$

$$w_{MC2} = (0.00074456)^{\frac{1}{4}} = 0.165129$$

- **Calculation for MC3 (Quality Assurance):**

$$w_{MC3} = (0.122520 \times 0.082832 \times 0.078080 \times 0.162187)^{\frac{1}{4}}$$

$$w_{MC3} = (0.00012853)^{\frac{1}{4}} = 0.106493$$

- **Calculation for MC4 (External Recognition):**

$$w_{MC4} = (0.122520 \times 0.142051 \times 0.078080 \times 0.162187)^{\frac{1}{4}}$$

$$w_{MC4} = (0.00022039)^{\frac{1}{4}} = 0.121855$$

- **Calculation for MC5 (Curricular Integration):**

$$w_{MC5} = (0.134730 \times 0.154348 \times 0.181524 \times 0.162187)^{\frac{1}{4}}$$

$$w_{MC5} = (0.00061217)^{\frac{1}{4}} = 0.157297$$

- **Calculation for MC6 (Regulatory Alignment):**

$$w_{MC6} = (0.112040 \times 0.126451 \times 0.157636 \times 0.074533)^{\frac{1}{4}}$$

$$w_{MC6} = (0.00016648)^{\frac{1}{4}} = 0.113651$$

- **Calculation for MC7 (Student Demand):**

$$w_{MC7} = (0.112040 \times 0.126451 \times 0.181524 \times 0.074533)^{\frac{1}{4}}$$

$$w_{MC7} = (0.00019177)^{\frac{1}{4}} = 0.117616$$

Results and Final Classification

The aggregate weights obtained using the geometric mean must be normalized so that their sum equals 1. This will give us the final percentage weight for each criterion.

Weight Normalization

- **Sum of the geometric mean weights:**

Addition= $0.160416 + 0.165129 + 0.106493 + 0.121855 + 0.157297 + 0.113651 + 0.117616$

Addition= 0.942457

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- **Weight normalization:**

$$w_j^{norm} = \frac{w_j}{Suma}$$

Applying normalization:

$$w_{MC1-norm} = \frac{0.160416}{0.942457} = 0.170238$$

$$w_{MC2-norm} = \frac{0.165129}{0.942457} = 0.175133$$

$$w_{MC3-norm} = \frac{0.106493}{0.942457} = 0.112981$$

$$w_{MC4-norm} = \frac{0.121855}{0.942457} = 0.129265$$

$$w_{MC5-norm} = \frac{0.157297}{0.942457} = 0.166929$$

$$w_{MC6-norm} = \frac{0.113651}{0.942457} = 0.120569$$

$$w_{MC7-norm} = \frac{0.117616}{0.942457} = 0.124872$$

Final Results Table

Table 9: Microcredential implementation criteria

Rank	Criterion	Description	Final Weight	Percentage
1	MC2	Teacher Training and Pedagogical Change	0.175133	17.51%
2	MC1	Technological Infrastructure and Platforms	0.170238	17.02%
3	MC5	Curricular Integration and Internal Recognition	0.166929	16.69%
4	MC4	External Recognition and Employability	0.129265	12.93%
5	MC7	Student Demand and Accessibility	0.124872	12.49%
6	MC6	Regulatory Alignment and Accreditation	0.120569	12.06%
7	MC3	Quality Assurance and Evaluation	0.112981	11.30%

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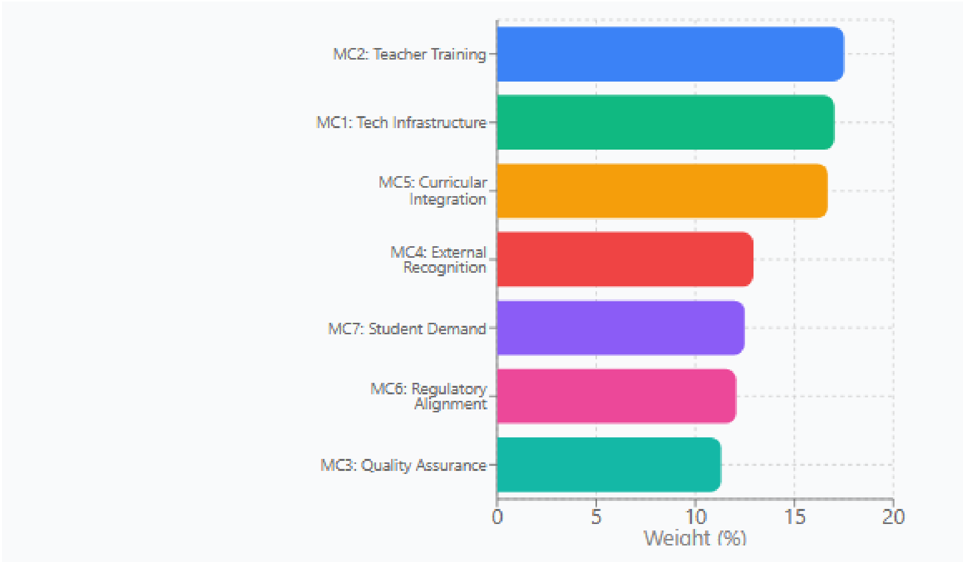

Figure 2. Final normalized weights showing Teacher Training and Pedagogical Change (MC2) as the highest priority at 17.51%, followed closely by Technological Infrastructure (MC1) at 17.02% and Curricular Integration (MC5) at 16.69%.

4. Discussion

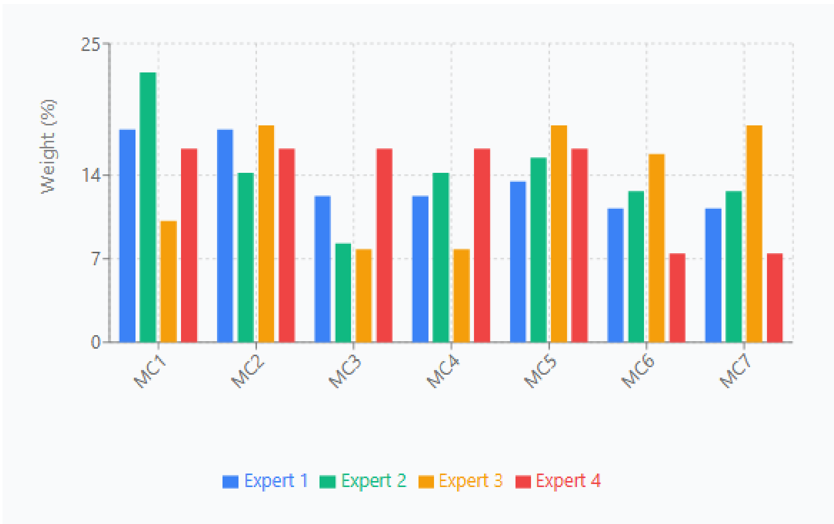

Figure 3. Comparative analysis of individual expert weightings before geometric mean aggregation. Note the variation in Expert 3's emphasis on MC7 (Student Demand) at 18.15% and Expert 4's uniform distribution across MC1-MC5 at 16.22%, demonstrating the diversity of expert perspectives captured by the NAHP methodology.

The results obtained from the application of the NAHP method offer a robust, quantitative perspective on the strategic priorities for implementing microcredentials in the Latin American university context. The analysis of the final hierarchy reveals significant implications for institutional decision-making.

The Primacy of Human, Technological and Political Factors

The most revealing finding is the triad of main criteria: **Teacher Training and Pedagogical Change (MC2)**, **Technological Infrastructure (MC1)** and **Curriculum Integration (MC5).** Together, these three factors account for more than 51% of the total decision-making weight. This indicates that, for experts, the success of educational flexibility through microcredentials depends on a balanced combination of people, platforms, and internal policies.

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The top ranking of **Teacher Training (17.51%)** refutes the notion that microcredentials are merely a technological challenge. In institutions accustomed to traditional educational models, the human factor is both the main barrier and the main facilitator. This result suggests that teachers should be the focus of the strategy, as they are the ones who must design and evaluate the new competency units. Without their buy-in and training, the initiative will fail.

Following closely behind are **Technological Infrastructure (17.02%)** and **Curriculum Integration (16.69%).** This confirms that the high cost and complexity of platforms (MC1) are a fundamental financial and technical barrier. However, of almost equal importance, experts point out that if these credentials are not integrated into existing curricula (MC5) and are not recognized by the university itself, they will become isolated efforts with no real value for the student's educational trajectory.

The Relegation of Quality and Regulation

It is notable that **Quality Assurance and Assessment (QA3)** ranks last (11.30%). This does not imply that quality is irrelevant; on the contrary, experts likely consider it a consequence of the other factors. The interpretation is that, if adequate teacher training is achieved (QA2) and robust platforms are in place (QA1), quality assurance mechanisms (QA3) can be built on that foundation. The challenge is not *designing* quality, but *achieving* the pedagogical change and investment that make it possible.

Similarly, **Regulatory Alignment (MC6)** is at the bottom. This could be interpreted as meaning that experts view regulation as an obstacle to be managed, but not as the primary driver of the decision. In the Latin American context, innovation often precedes regulation, and universities must first build internal success stories (MC5) before pushing for changes in accreditation.

Contribution and Robustness of the NAHP Method

The use of the NAHP was crucial. A traditional approach would not have captured the high level of uncertainty (indeterminacy) that experts expressed regarding external recognition (MC4) or the complexity of curriculum integration (MC5). The method's ability to handle judgments with degrees of truth, indeterminacy, and falsity (neutrosophic numbers) provided a realistic framework. The consistency of judgments was verified, and aggregation using the geometric mean ensured a balanced consensus.

5. Conclusion

Such a systematic approach through the NAHP process has brought a definitive ranking of factors that should prioritize the implementation of microcredentials in Latin American higher education institutions for successful educational flexibilization. The united findings of all five studies show that human, technological and internal policy factors are pivotal. Teacher Training and Pedagogical Change (MC2) is the top priority (17.51%) because it is fundamentally a human aspect that will determine success through teaching staff adaptation and willingness to open to new methodologies. In second and third place are Technological Infrastructure (MC1) (17.02%) and Curricular Integration (MC5) (16.69%) which further imply that this will work only if political investment is devoted to platforms and a subsequent political decision is made to include these new credentials in formal training processes, showing that legitimization and infrastructure goes hand in hand. Factors from the external part of the operation, however, have been positioned in the middle at fourth and fifth place: External Recognition (MC4) and Student Demand (MC7), implying that they are significant repercussions to be managed, but they first rely on internalization of the model. Last, Quality Assurance (MC3) is the lowest priority at 11.30% but it is merely an implausible technical hurdle that may be overcome once teaching and investment hurdles subside. Ultimately, the NAHP tool serves as an effective decision-making process so that academic managers know where to channel scarce resources for the greatest possibility of successful adaptable and flexible education.

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