

## Improving leadership selection in higher education through multicriteria decision analysis

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**Abstract:** In higher education institutions, the selection of senior administrators such as campus directors is a critical decision-making process that impacts institutional leadership, planning, and academic performance. Despite its importance, the process is typically conducted without formal decision support tools, considering the multidimensional nature of leadership competencies. This work proposes the development of a multicriteria decision aid (MCDA) model for a transparent and methodical director selection. The model employs a mixed-methods design, utilizing qualitative interviews and quantitative questionnaire outcomes to identify and formalize relevant decision criteria. It applies the Value-Focused Thinking approach to organize strategic, fundamental, and operational objectives, alongside the hierarchical interval outranking method to approximate decision-maker preferences under uncertainty and create an ordinal classification of candidates. This approach enables the management of complex evaluation schemes, including hierarchically structured and interacting criteria. The application of the model in a case study involving more than 120 national campuses across Mexico demonstrates that the proposal facilitates better-informed, consistent, and transparent selections compared to typical ad-hoc methods.

**Keywords:** Competency-based evaluation, Hierarchical interval outranking, Leadership selection, Multicriteria ordinal classification, Outranking approach.

### 1. Introduction

Leadership plays a critical part in shaping the direction, performance, and identity of universities. With an ever-changing higher education landscape, universities are required to improve governance, accountability, and responsiveness to a wide range of competing internal and external demands. Possibly the most important position in any university is the campus and senior administrator, since they are leaders responsible for establishing institutional direction, promoting academic success, budgeting, and serving as the chief representatives. Despite the strategic importance of such roles, hiring processes for directors at universities seldom use a formal decision framework and instead rely on politics, informal referrals, or, in general, non-existent eligibility criteria (McMullen, 2025; Ruben, Mahon, & Shapiro, 2022; Santiago, Tremblay, Basri, & Arnal, 2008). This approach increases the likelihood of an institutional requirement-leadership capacity mismatch, which undermines institutional performance and public trust (Ordorika & Lloyd, 2015).

The recent years have witnessed an increased call within the academic community for applying evidence-based practices in university leadership, including the selection of leaders. Competency-based

models have emerged in this context as they emphasize the connection between the personal traits of the applicants and the strategic needs of institutions. Competency models for higher education typically cover a wide range of qualities, such as leadership potential, communicative ability, strategic thinking, administrative expertise, academic qualifications, and moral behavior. While these competencies are regarded as necessary, their use in decision-making is highly intuitive and personal. There is a pressing need for an open and systematic model to evaluate and choose university leaders against several competencies and organizational priorities.

Multicriteria Decision Analysis (MCDA) offers a sound methodology for addressing this issue. MCDA is a set of methods designed to support decision-making in multi-faceted problems involving a number of usually competing criteria that must be weighed simultaneously. Unlike traditional selection or assessment models on one dimension (e.g., experience, level of studies), MCDA addresses the multi-faceted nature of leadership and provides instruments to express preferences, uncertainty, and compromises in a transparent and systematic way. Among its advantages, MCDA allows institutions to incorporate decision-makers' judgments, handle imprecise or incomplete data, and represent hierarchical and interacting criteria. It can be optimally applied in the selection of leaders in universities, where institutional heterogeneity, stakeholder demands, and strategic fit need to be balanced with wisdom. This study proposes the development and use of a multicriteria decision aid model for the ease of selecting campus directors in higher education institutions. As a case study, this research focuses on the National Technological Institute of Mexico (TecNM), one of Latin America's largest higher education systems. TecNM is among the top institutions in Mexico for acquiring professional and technological education. It has more than 250 schools and over 600,000 students (Tecnológico Nacional de México, 2025). It has both federal and decentralized campuses, each with its own set of needs, problems, and features. However, the current method of selecting directors is neither formalized nor straightforward. Present approaches depend on broad criteria that emphasize academic credentials and administrative experience, but they lack a decision-making framework to evaluate candidates comprehensively or to rank skills based on specific campus requirements.

The work used a mixed-methods approach, integrating qualitative interviews with administrators and quantitative survey responses to formulate, validate, and prioritize decision-making factors. According to the Value-Focused Thinking approach, the methodology emphasizes identifying and clarifying values to guide decision-making processes effectively (Keeney, 1992; López-Otín, Blasco, Partridge, Serrano, & Kroemer, 2023). The study classifies decision objectives as strategic, fundamental, and means-ends. For the treatment of uncertainty management and hierarchical systems, the model includes the hierarchical interval outranking method proposed by (Fernández, Navarro, & Solares, 2022) and recently exploited by several works in the literature (Fernández, Figueira, Navarro, Picos, & Solares, 2025; Fernández, Figueira, Navarro, & Solares, 2023). This method permits fuzzy preferences and interacting criteria to be represented in a multi-level hierarchy, ultimately the ideal marriage for the complex decision-making context of higher education leadership. The proposed model strives to provide actionable information to TecNM and other university systems facing similar issues to guide decision-makers. It aims to facilitate more transparent, more equitable, and more informed decisions, reduce decision-making load for selectors, and provide assurance that leadership appointments are directed toward institutional strategy and performance goals. The method is also flexible and scalable so that its application may be applied across other university governance roles such as the selection of vice directors, department heads, or administrative officers. Moreover, it is designed in such a way to be integrated into computer platforms or decision-support packages in the future, thus making it more relevant to actual use in decision-making environments.

The paper is structured as follows: Section 2 presents relevant literature on personnel selection, competencies in leadership in academe, and multicriteria decision methods. Section 3 outlines the research methodology, including the design of the evaluation model, the selection of criteria, and the use of the hierarchical outranking method. The final sections will present the findings, discuss their implications, and make conclusions and recommendations for future research.

## 2. Literature Review

### 2.1. Selection And Evaluation of University Leaders

Historically, selection criteria have included educational qualifications (most often doctoral degrees), years of experience as a teacher, previous administrative roles, and reputation in general (Bryman, 2007). These criteria, however, do not fully represent the range of skills required of leaders in the contemporary environment of higher education. The increasingly intricate and competitive landscape of international higher education necessitates leaders who are not simply academics but also strategic thinkers, catalysts for change, financial stewards, and effective communicators (Black, 2015; Middlehurst, 2004).

If leaders are evaluated, it is usually not done very often and not based on a set of standards that are always the same. These evaluations may concentrate on outcomes such as boosting enrollment, securing additional research funding, or achieving accreditation; nevertheless, they neglect the relational and transformative dimensions of leadership (Rowley & Sherman, 2003; Ruben et al., 2022; Smith & Perez, 2024).

For higher education, leadership competencies often include strategic thinking, communication, adaptability, ethical judgment, stakeholder management, and the ability to achieve academic excellence (Leithwood & Riehl, 2003). Competency models provide a structured framework for evaluating the congruence between institutional needs and leadership skills. The European Higher Education Leadership Competency Framework, for example, emphasizes governance, external affairs, and innovation potential as thematic areas (European Commission, 2013). Inclusive leadership, stewardship of finances, and data-informed decision-making are also emphasized by the American Council on Education as the primary competencies for presidents and provosts (Gagliardi, Espinosa, Turk, & Taylor, 2017).

In Mexico, the TecNM has also defined a list of competencies for its directors, which include leadership, strategic vision, communication, teamwork, and administrative skills, although these are not necessarily incorporated into formal selection tools (Tecnológico Nacional de México, 2025). In many countries, such as the United Kingdom, Canada, and Australia, search committees composed of faculty, staff, and external stakeholders are formed to make public appeals, evaluate candidates based on predetermined criteria, and engage the community in consultation processes (AGB Search, 2024; Bargh, Scott, & Smith, 2000; Smith & Perez, 2024; Wolverton & Gmelch, 2002). The goal of these activities is to make institutions more legitimate and ensure that staff hires align with the organization's mission and values. However, even in such contexts, there are still problems. A study by Lüthje and Neugebauer (2011) found that gender bias and disciplinary stereotypes still inform leadership fit impressions. Conversely, Hazelkorn (2015) observed that many appointment processes, as much as they are bureaucratically onerous, still do not challenge strategic acumen or leadership transformation, which are critical in today's rapid-paced higher education situations.

There is an increasing agreement that effective leadership recruitment should go beyond academic qualifications and years of experience to evaluate a wider range of competencies pertinent to business objectives and stakeholder requirements. Some researchers advocate the use of multi-faceted models that integrate both qualitative and quantitative assessments, such as structured interviews, 360-degree feedback, psychometric tests, and simulation exercises (McCarthy & Garavan, 2008). These technologies, as effective as they are, rarely have an integrated mechanism in place, one that can aggregate varied data into a final evaluation or choice. This gap provides an opportunity for MCDA as an explicit approach to synthesizing, weighing leadership skills openly and reliably. MCDA models can help decision-makers manage trade-offs, such as the values of stakeholders, and reduce bias thus making them highly appropriate for leadership selection in sophisticated institutional environments like universities (De Almeida, Cavalcante, Alencar, Ferreira, & de Almeida-Filho, 2015).

### 2.2. MCDA Methods and Their Application to Leadership Selection

MCDA is particularly relevant in multi-attribute decision environments where trade-offs have to be made, and decisions cannot be classified by one dimension, such as cost or experience (Bryman, 2007;

Díaz-Navarro et al., 2024; Fernández et al., 2022). MCDA is better than standard scoring or unstructured interviews because it helps decision-makers clarify their preferences, prioritize assessment criteria, and make consistent decisions when they are unsure of what to do (Díaz-Navarro et al., 2024; Middlehurst, 2004). This makes it especially better for selecting leaders, when evaluating candidates involves taking into account different stakeholder opinions, unclear information, and often conflicting institutional aims (Keeney & Raiffa, 1993).

There are many MCDA methods, each with its own strengths and weaknesses that make them better or worse for the problem at hand. The Analytic Hierarchy Process (AHP), created by Saaty (1980), breaks down difficult choices into a hierarchy and uses pairwise comparisons to determine the relative weights of criteria. AHP is easy to use, but it can become inconsistent with many criteria or alternatives. Developed by Hwang and Yoon (1981), the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) selects the alternative closest to the ideal solution and furthest from the worst. It requires precise data and is less suitable for qualitative decisions. Developed by Brans and Vincke (1985), the Preference Ranking Organization Method for Enrichment Evaluations (PROMETHEE) method uses outranking relations to compare alternatives based on their preference functions. PROMETHEE deals with imprecise data and is generally used in strategic planning and personnel management. Developed by Roy (1991), the Elimination and Choice Translating Reality (ELECTRE) method is an outranking method using concordance and discordance indices to approximate the relative performance of alternatives. ELECTRE III, in particular, supports decision-making where information is imperfect, with indifference, preference, and veto thresholds. This makes ELECTRE III especially applicable for leadership evaluation when data is imprecise or of a judgmental nature (Fernández et al., 2022; Roy, 1991). Built by Keeney (1992), Value-Focused Thinking (VFT) is concerned with specifying and describing the fundamental objectives before considering alternatives. VFT encourages simplicity and imagination in complex decisions and works best when crafting leadership choice models early.

Although MCDA has been applied broadly in areas such as environmental planning, public policy, and project selection, its application in human resource planning and leadership selection specifically is on the rise. MCDA has been used to facilitate employee decision-making (Figueira, Greco, & Ehrgott, 2005), screen potential employees (Dolgin, Karnieli-Miller, & Eisikovits, 2012), and assist in succession planning in public agencies (Roodhooft & Van den Abbeele, 2006).

For example, Cardoso, Costa, and Oliveira (2012) utilized the ELECTRE TRI method to rank and select candidates for public recruitment in Portugal based on technical skills as well as behavioral competencies. Similarly, Kabak, Uyar, Cevik Onar, Yavuz, and Öztürk (2014) utilized AHP and PROMETHEE to evaluate managerial candidates in a Turkish university. The two studies demonstrated that MCDA makes choices traceable to decision-makers in terms of the compromises involved in choosing one candidate over another, as well as transparent and traceable decisions. In education, McCowan (2010) emphasized the potential of applying MCDA in marrying recruitment and leadership development processes with institutional values and missions. But for as much promise, MCDA still remains to be widely embraced in Latin American university systems, whose recruitment procedures are typically more politicized or ad hoc.

In situations like the selection of campus directors in TecNM, where multi-level criteria (strategic, tactical, operational) and imprecise or interval-based evaluations are involved, hierarchical outranking models do have some additional advantages. The INTERCLASS method (Fernández et al., 2022) extends the ELECTRE III method to handle criteria structured hierarchically and imprecise evaluations based on intervals. This is particularly relevant in higher education, where there may be reluctance to assign specific abilities to a candidate or where criteria interact in non-linear ways (e.g., strategic vision with communication skills being more valuable than either ability separately). By providing responses to evaluations such as “between 3 and 4 on a scale of 5,” and by modeling preference interactions, INTERCLASS enhances decision process realism and robustness. These models are also well-suited to participatory decision-making, as they enable different stakeholders to express preferences, priorities,

and concerns without requiring exact quantification. In the TecNM case, involving both central authorities and campus stakeholders in the modeling exercise through such methods could lead to more legitimate and widely accepted outcomes.

### 2.3. Hierarchical Interval Outranking Approach

The so-called outranking approach is widely mentioned in the literature regarding MCDA. This approach is a multi-criteria decision methodology used to rank, sort (ordinal classification), or select among several possible options. From the MCDA literature, the family of ELECTRE ("Élimination Et Choix Traduisant la Réalité") is the most prominent methods that use the outranking approach.

For homogeneity purposes, we will use here part of the notation adopted by Fernández et al. (2022).

- Let  $A$  be the set of alternatives (potential actions).
- Let  $I_g$  be the set of indices of all criteria in the hierarchy.
- Let  $\chi = \{g_i, g_j, \dots, g_{card(I_g)}\}$  be the set of all criteria in the hierarchy. Without loss of generality, we assume that preference increases in the sense of criterion values.
- Let  $EL$  be the set of indices of all elementary criteria.
- Let  $N_h$  be the number of immediate sub-criteria of a non-elementary criterion  $g_h$ .
- Let  $G_h = \{g_{h1}, \dots, g_{hN_h}\}$  be the set of immediate sub-criteria of a non-elementary criterion  $g_h$ . If  $g_j \in G_h$ , then  $g_j$  is said to be an immediately descending criterion of  $g_h$ , and this is an immediately ascending criterion of  $g_j$ .
- Let  $I_{G_h}$  be the set of indices of all criteria in  $G_h$ .
- Let  $EL(h)$  be the set of indices of all elementary criteria that influence a non-elementary criterion  $g_h$ ;
- Let  $D(h)$  be the set of indices of all criteria influencing a non-elementary criterion  $g_h$  from a lower hierarchical level; When  $j \in D(h)$ , then  $g_j$  is said to be a descendant of  $g_h$ .

The following concepts are added to the notation:

- Let  $EL_p$ , a subset of  $EL$ , be the set of indices of all criteria that are pseudo-criteria, i.e., the subset of criteria where the performance of alternatives is not measured using interval numbers.
- Let  $EL_i$ , a subset of  $EL$ , be the set of indices of all criteria that are interval numbers.

Fernández et al. (2022) recommend using a partial outranking relationship, denoted as  $S_j \subseteq A \times A$ , associated with each criterion  $g_j \in EL$ . This serves to signal that " $a$  is at least as good as  $b$  from the perspective of  $g_j$ " ( $a, b \in A \times A$ ), along with a degree of credibility that is satisfied  $a S_j b$ ,  $\delta_j(a, b)$ . The calculation of  $\delta_j(a, b)$  depends on whether  $g_j$  is a pseudo-criterion or an interval number. Thus, when  $g_j$  is an interval number, that is,  $g_j \in EL_i$ :

$$\delta_j(a, b) = P(g_j(a) \geq g_j(b)).$$

And when  $g_j \in EL_p$ :

$$\delta_j(a, b) = \begin{cases} 1 & \text{if } g_j(b) - g_j(a) \geq p_j, \\ \frac{g_j(a) - g_j(b) + p_j}{p_j - q_j} & \text{if } g_j(b) - p_j \leq g_j(a) < g_j(b) - q_j, \\ 0 & \text{if } g_j(a) - g_j(b) \geq -q_j. \end{cases}$$

where  $p_j$  and  $q_j$  represent the preference and indifference thresholds for the criterion  $g_j$ . The first establishes a range where the policymaker has a strict preference for one of the alternatives; the second establishes a range where the policymaker is indifferent, given that the performance of the alternatives is similar enough.

Now, the degree of credibility of  $a S_j b$  when  $h \notin EL$ , denoted by  $\sigma_h(a, b)$ , can be computed recursively by adding all  $\sigma_h(a, b)$  values to  $g_j \in G_h$ , note that, when  $g_j \in EL$ , then:

$$\sigma_h(a, b) = \delta_h(a, b) \quad (1)$$

Such aggregation requires a criterion weight (considered as a relative importance coefficient) that must be defined for each  $g \in G_k$ ; let us denote this weight by  $w_{gk}$ . Other parameters associated with  $g \in G_k$  can also be defined, such as a veto threshold,  $v_{gk}$  (rejecting any credibility of  $aS_k b$  if  $g(b)$  exceeds  $g(a)$  by an amount greater than  $v_{gk}$ ). These parameters allow the calculation of a Concordance- $\gamma$  index related to  $S_k$ ,  $c_k(a, b, \gamma)$ . This value represents the support of the coalition of criteria in accordance with  $aS_k b$ , where  $\gamma$  is the highest credibility value of these criteria that support the claim. The degree of credibility of the statement “the considered  $\gamma$ -concordance coalition is sufficiently strong” is then calculated as  $P(c_k(a, b, \gamma) \geq \lambda_k)$ , where  $\lambda_k$  is a threshold set by the DM to establish what constitutes a strong majority. The reader is referred to Fernández et al. (2022), see the details in the calculation of  $c_k(a, b, \gamma)$ , as well as some restrictions that the parameters mentioned above must meet.

#### 2.4. Ordinal Ranking Using Interval-Based Hierarchical Outranking Approach

Using the notation introduced in Section 2.3, the interval-based hierarchical outranking approach can be employed to perform the ordinal classification of the capital cities using the following procedure (Fernández et al., 2022):

The HI-INTERCLASS-nC method is a novel approach that exploits the interval-based hierarchical outranking technique to assign alternatives to preferentially ordered classes. This methodology allows assignments to be made at the level of any non-elementary criterion  $g_k$ .  $C^k$  is defined as a finite set of classes  $C^k = \{C_1, \dots, C_{k1}, \dots, C_M\}^k$ , where  $M \geq 2$ , ordered with increasing preference with respect to  $g_k$ . The subset  $R_k = \{r_{kj}, j = 1, \dots, \text{card}(R_k)\}$  represents the reference alternatives that characterize  $C_k$ , with  $k = 1, \dots, M$ . The total set of reference alternatives is  $\{r_0, R_1, \dots, R_M, r_{M+1}\}$ , where  $r_0$  and  $r_{M+1}$  are the anti-ideal and ideal alternatives, respectively.

The credibility indices between an alternative  $a$  and the class  $C_k$  are defined as:

$$\sigma_h(\{a\}, R_k) = \max_{j=1, \dots, \text{card}(R_k)} \{\sigma_h(a, r_{kj})\}$$

$$\sigma_h(R_k, \{a\}) = \max_{j=1, \dots, \text{card}(R_k)} \{\sigma_h(r_{kj}, a)\}$$

Where  $\sigma_h(a, r_{kj})$  is calculated through Eq. (1).

For given  $\beta > 0.5$ , hierarchical categorical outranking relationships are defined as follows:

- a)  $aS_h(\beta)R_k \Leftrightarrow \sigma_h(\{a\}, R_k) \geq \beta$ ;
- b)  $R_k S_h(\beta)a \Leftrightarrow \sigma_h(R_k, \{a\}) \geq \beta$ .

The selection function is defined as:  $i_h(\{a\}, R_k) = \min\{\sigma_h(\{a\}, R_k), \sigma_h(R_k, \{a\})\}$ .

HI-INTERCLASS-nC uses two joint rules to suggest assignments: the descending rule and the ascending rule, which must be used together. Each of these rules selects only one class for the possible assignment of an alternative.

Descending assignment rule: Set  $\beta$  and  $\lambda$ . Define the set of classes  $C^k$  and the representative subsets of alternatives  $\{r_0, R_1, \dots, R_M, r_{M+1}\}$ .

- Compare  $a$  with  $R_k$  for  $k = M, \dots, 0$ , up to the first value,  $k$ , such that  $aS_h(\beta)R_k$ .
- For  $k = M$ , select  $C_M$  as a possible category to assign  $a$ .
- For  $0 < k < M$ , if  $i_h(\{a\}, R_k) \geq i_h(\{a\}, R_{k+1})$ , then select  $C_k$  as a possible category to assign  $a$ ; otherwise select  $C_{k+1}$ .
- For  $k = 0$ , select  $C_1$  as a possible category to assign  $a$ .

Ascending allocation rule: Set  $\beta$  and  $\lambda$ . Define the set of classes  $C^k$  and the representative subsets of alternatives  $\{r_0, R_1, \dots, R_M, r_{M+1}\}$ .

- Compare  $a$  with  $R_k$  for  $k = 1, \dots, M+1$ , up to the first value,  $k$ , such that  $R_k S_h(\beta)a$ .
- For  $k=1$ , select  $C_1$  as a possible category to assign  $a$ .

- For  $1 < k < M + 1$ , if  $i_k(\{a\}, R_k) \geq i_k(\{a\}, R_{k-1})$ , then select  $C_k$  as a possible category to assign  $a$ ; otherwise select  $C_{k-1}$ .

For  $k = M + 1$ , select  $C_M$  as a possible category to assign  $a$ .

### 3. Materials and Methods

The construction of the multicriteria decision approach is divided into three phases. The process begins by identifying what leaders value and expect, then proceeds to creating assessment criteria, building the decision approach using the INTERCLASS technique, and ultimately testing it through expert review. This method combines qualitative insights from institutional stakeholders with the formal logic of multicriteria decision analysis.

#### 3.1. Phase I: Finding Stakeholders and Objectives

The first step in the technique is to make the institutional goals that should govern the selection of campus directors clearer and to identify the stakeholders who are involved in or affected by those goals. This phase is based on the principles of VFT (Keeney, 1992). Rather than starting with pre-defined criteria or candidate profiles, this phase seeks to answer the core question: “What should a university expect from its leaders?”

##### 1. Identifying stakeholders

Interviewees who reflected various functions and viewpoints include:

- Heads of administrative units from TecNM's General Directorate (e.g., Planning Coordination, Human Capital).
- Previous and sitting directors of campuses with firsthand understanding of responsibility for leading selection processes.
- Academically trained experts in education management and public policy-making.
- Mid-level managers like department heads or area coordinators.

There were 13 respondents who were interviewed one-on-one or in small focus groups using semi-structured interviews over a period of six weeks. Their interviews provided insights into unexpressed expectations, frustrations, and even dreams surrounding campus leadership.

#### 3.2. Identifying Objectives

Interviewees were guided with open-ended questions such as:

- “What should be a preferred behavior for a student leader?”
- “What behaviors or capabilities set effective directors apart from ineffective directors?”
- “What Institutional Risks Do Poor Leadership Decisions Create?”

The data was encoded and consolidated via content analysis to disclose emergent patterns as well as objectives. The objectives also appeared hierarchically organized in a value tree with three levels (Keeney, 1992):

- A. Strategic objectives: represent the broad, long-term impacts expected from the director's performance.
- B. Fundamental objectives: describe mid-level outcomes necessary to achieve the strategic aims:
- C. Operational objectives: cover day-to-day competencies and behaviors that contribute to effective leadership.

##### 3.2.1. Strategic Objectives

- Ensure mission alignment and sustainability of the institution.
- Promote innovation and transformation aligned with national and institutional development goals.
- Position the campus as a regional or national leader in academic and technological development.

### 3.2.2. *Fundamental Objectives*

- Develop and maintain an inclusive and participatory leadership style.
- Ensure compliance with institutional policies and effective resource management.
- Strengthen academic quality and accreditation processes.

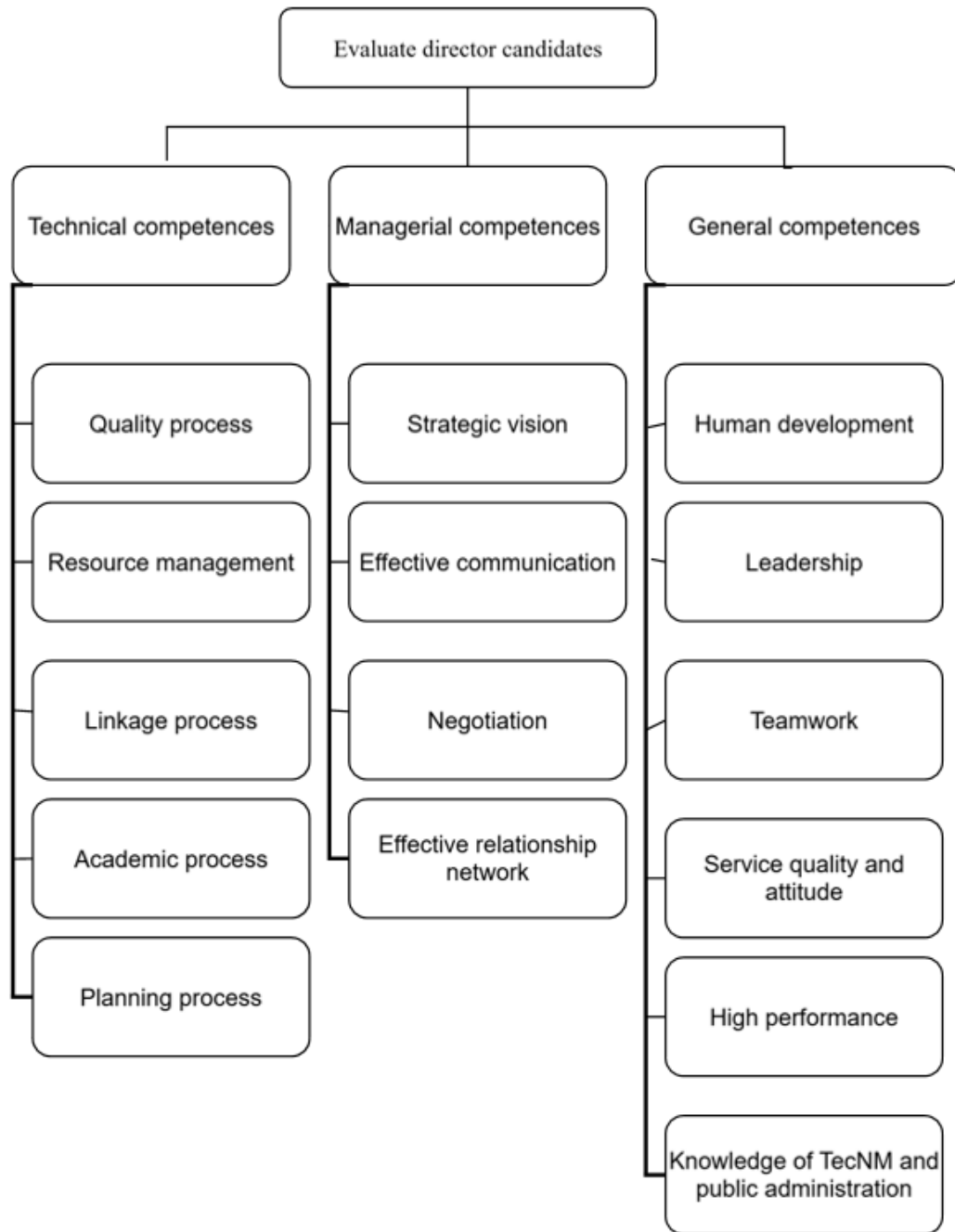
### 3.2.3. *Operational Objectives*

- Demonstrate ethical integrity and impartial decision-making.
- Manage time, conflicts, and priorities effectively.
- Communicate clearly with internal and external stakeholders.
- Foster teamwork and empower staff.
- Maintain accountability and a results-oriented mindset.

Each of these objectives was later translated into evaluation criteria in Phase II, with clear definitions and corresponding performance scales.

### 3.3. *Phase II: Organizing the Multicriteria Assessment Model*

During this phase, the basic goals that were stated in Phase I are transformed into a well-organized set of evaluation criteria. This method involves delineating, structuring, and implementing the values, expectations, and performance metrics into a formal multicriteria framework that creates a coherent family of assessment criteria (Roy, 1996). The model is built on a hierarchical framework of criteria, which makes it easy for decision-makers to use while still being flexible enough to reflect the complexities of university leadership jobs. Each level records a different aspect of performance, which makes it possible to do a tiered examination of leadership potential and allows institutions to give varying weights to different levels based on their own priorities. These goals were turned into a “coherent family of criteria,” as Roy (1996) said they should be. Figure 1 shows the order of the criteria.



**Figure 1.**  
A coherent family of criteria structured as a hierarchy.

In Table 1, we use the notation proposed in Fernández et al. (2022) to denote the criteria.

**Table 1.**

Notation used to represent the criteria.

| Notation | Criterion                                    |
|----------|----------------------------------------------|
| $G$      | Evaluate director candidates                 |
| $G_1$    | Technical competencies                       |
| $g_{11}$ | Quality process                              |
| $g_{12}$ | Resource management                          |
| $g_{13}$ | Linkage process                              |
| $g_{14}$ | Academic process                             |
| $g_{15}$ | Planning process                             |
| $G_2$    | Managerial competencies                      |
| $g_{21}$ | Strategic vision                             |
| $g_{22}$ | Effective communication                      |
| $g_{23}$ | Negotiation                                  |
| $g_{24}$ | Effective relationship network               |
| $G_3$    | General competencies                         |
| $g_{31}$ | Human development                            |
| $g_{32}$ | Leadership                                   |
| $g_{33}$ | Teamwork                                     |
| $g_{34}$ | Service quality and attitude                 |
| $g_{35}$ | High performance                             |
| $g_{36}$ | Knowledge of TecNM and public administration |

### 3.4. Phase III: Application of the HI-INTERCLASS-nC Method

Each criterion in Table 1 is evaluated on a 5-point ordinal scale, with performance intervals (e.g., “between 3 and 4”) allowed. This enables capturing ambiguous or partial knowledge about candidates. Thresholds and weights must also be defined. These are directly elicited using the characteristics of the HI-INTERCLASS-nC method, which allows for these parameters to have some vagueness that facilitates the decision-maker’s task of directly providing the values. The decision-maker stated that all of the criteria can be treated as equally important, while no relevance has been given to veto situations for the moment, and the following classes of director candidates were provided by him:

- Excellent candidate – Class 3.
- Acceptable candidate but with observations – Class 2.
- Non-acceptable candidate – Class 1.

Finally, a set of preferentially ordered classes is defined by the decision maker that reflects his intentions for evaluating the candidates.

**Table 2.**

Reference profiles were assessed on the elementary criteria.

|          | $F_{1,1}$ | $F_{2,1}$ | $F_{3,1}$ |
|----------|-----------|-----------|-----------|
| $g_{11}$ | 3 5       | 5 6       | 8 9       |
| $g_{12}$ | 3 4       | 7 8       | 7 9       |
| $g_{13}$ | 2 4       | 6 7       | 8 9       |
| $g_{14}$ | 3 5       | 7 9       | 9 10      |
| $g_{15}$ | 3 3       | 7 7       | 8 9       |
| $g_{21}$ | 4 5       | 7 7       | 10 10     |
| $g_{22}$ | 2 4       | 5 7       | 8 9       |
| $g_{23}$ | 3 3       | 5 7       | 9 10      |
| $g_{24}$ | 3 5       | 6 7       | 9 9       |
| $g_{31}$ | 2 3       | 5 6       | 9 10      |
| $g_{32}$ | 3 4       | 5 7       | 9 10      |
| $g_{33}$ | 3 5       | 6 6       | 8 10      |
| $g_{34}$ | 4 4       | 6 8       | 9 10      |
| $g_{35}$ | 2 3       | 6 6       | 9 10      |
| $g_{36}$ | 3 4       | 4 6       | 9 10      |

Now, to assess the proposed multicriteria evaluation model for university director selection, the following experimentation procedure is adopted.

A total of 20 candidates were considered, each representing plausible leadership profiles that vary in strength across different performance dimensions. These profiles were defined using the same 1–10 evaluation scale used in the real decision-making scenario, but to better reflect real-world uncertainty and variability in judgment, performance was expressed as intervals (e.g., “6 8” or “7 9”). This method allows the model to handle vague or inaccurate evaluations, which are common in leadership assessments due to personal biases, missing information, or disagreements among evaluators.

The INTERCLASS method was then applied to the same 20 profiles using the predefined weights, thresholds, and hierarchical structure of the model to assign them to one of the three predefined classes: Excellent, Acceptable but with Recommendations, and Not Acceptable. The 20 candidates, denoted as  $C_1$ – $C_{20}$ , and their assessments are shown in Table 3.

**Table 3.**

Simulated candidates to be evaluated by the proposed model.

|          | $g_{11}$ | $g_{12}$ | $g_{13}$ | $g_{14}$ | $g_{15}$ | $g_{21}$ | $g_{22}$ | $g_{23}$ | $g_{24}$ | $g_{31}$ | $g_{32}$ | $g_{33}$ | $g_{34}$ | $g_{35}$ | $g_{36}$ |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| $C_1$    | 8        | 9        | 9        | 4        | 8        | [2,4]    | 8        | 9        | [7,8]    | [2,3]    | 6        | [7,8]    | [5,6]    | [8,9]    | 9        |
| $C_2$    | 5        | [5,5]    | [8,10]   | [3,4]    | 4        | [7,9]    | [7,8]    | [6,7]    | 9        | [4,5]    | 9        | [7,8]    | [4,4]    | [7,8]    | 3        |
| $C_3$    | 4        | 8        | [5,7]    | [4,6]    | 5        | 4        | 3        | [3,4]    | [9,9]    | 6        | [2,4]    | 8        | [3,4]    | [5,6]    | 8        |
| $C_4$    | [5,6]    | 3        | [5,5]    | [7,8]    | [8,9]    | 3        | [4,5]    | [2,4]    | [6,7]    | 9        | [6,6]    | [6,6]    | [4,5]    | 5        | [5,7]    |
| $C_5$    | 7        | 9        | [4,5]    | 8        | 3        | [8,8]    | [7,8]    | 6        | 9        | [3,3]    | [4,4]    | [6,6]    | [6,8]    | [5,7]    | [6,8]    |
| $C_6$    | 3        | 9        | [7,8]    | 9        | 7        | 3        | [8,10]   | [3,5]    | [4,5]    | 3        | [7,7]    | [8,9]    | [2,4]    | [2,3]    |          |
| $C_7$    | 6        | [9,10]   | 9        | [2,4]    | [3,3]    | [3,4]    | 3        | [5,7]    | [3,4]    | [5,6]    | 4        | [3,5]    | [6,6]    | [4,6]    | [8,9]    |
| $C_8$    | [4,6]    | 6        | [2,4]    | [2,3]    | 6        | [4,4]    | [7,7]    | [7,7]    | 3        | 7        | 8        | [6,8]    | [3,4]    | 3        | [5,6]    |
| $C_9$    | 5        | [3,4]    | [6,6]    | [7,7]    | [6,8]    | [7,9]    | 5        | 9        | 6        | 9        | [4,5]    | 6        | 4        | [5,7]    | 4        |
| $C_{10}$ | 3        | [2,4]    | [4,5]    | [8,9]    | 7        | 5        | [2,4]    | [6,8]    | [3,5]    | [4,6]    | [8,9]    | [9,10]   | [3,3]    | [8,8]    | [7,8]    |
| $C_{11}$ | [8,10]   | [4,5]    | 3        | [8,9]    | [7,8]    | [4,5]    | 3        | [5,6]    | 5        | 3        | [4,4]    | [4,4]    | [5,6]    | [8,9]    | [5,6]    |
| $C_{12}$ | [5,6]    | [8,9]    | [8,9]    | [8,10]   | [7,8]    | [3,4]    | [5,7]    | 6        | 7        | 9        | 3        | [3,4]    | [4,5]    | [5,6]    | 4        |
| $C_{13}$ | [2,3]    | [6,6]    | 7        | [5,6]    | 7        | [5,5]    | 5        | 3        | 9        | [8,9]    | 5        | [4,5]    | 4        | [4,5]    | [8,8]    |
| $C_{14}$ | [6,7]    | 4        | 6        | 6        | 7        | 5        | [6,6]    | 5        | [4,5]    | [3,4]    | [7,9]    | 3        | 8        | [3,4]    | 9        |
| $C_{15}$ | [7,8]    | [2,4]    | [6,7]    | [5,7]    | 6        | 5        | [3,5]    | 4        | 7        | [8,10]   | [3,4]    | 4        | [4,5]    | 4        | [4,4]    |
| $C_{16}$ | 7        | [4,5]    | 5        | 3        | [6,6]    | 8        | 5        | 8        | [4,5]    | [4,6]    | 8        | [6,7]    | [5,6]    | [4,5]    | 6        |
| $C_{17}$ | 9        | 9        | [6,7]    | 6        | [9,10]   | [4,6]    | [2,4]    | 6        | [5,7]    | [6,8]    | [2,3]    | [2,3]    | 9        | 9        | [5,5]    |
| $C_{18}$ | 3        | [8,9]    | 5        | [7,9]    | 5        | 8        | [9,10]   | 9        | [9,10]   | [8,9]    | [2,3]    | 5        | [5,5]    | [2,4]    | 7        |
| $C_{19}$ | 6        | [8,9]    | 5        | 4        | [5,6]    | [7,8]    | [7,8]    | [7,7]    | 8        | [8,10]   | 7        | [6,8]    | [9,9]    | [7,8]    | 9        |
| $C_{20}$ | 9        | [7,8]    | [4,5]    | [3,4]    | [7,9]    | 5        | [4,5]    | [4,5]    | 3        | 8        | [4,5]    | 8        | 6        | 8        | [4,5]    |

## 4. Results and Discussion

Figure 1 presents a preliminary result of the research. It reflects, in the form of a hierarchy, the qualitative exploration carried out to identify the main criteria for assessing the decision alternatives. This section exploits this hierarchy to determine the preferential category to which each alternative belongs.

The classification of the 20 university director candidates provided by the decision-maker, at the overall criterion  $G$ , is shown in Subsection 4.1; evidently, such classification depends on the parameter values used by the approach. Therefore, Subsection 4.2 provides a sensitivity analysis where such results are tested by modifying the parameter values. The classifications performed at levels  $G_1$ ,  $G_2$ , and  $G_3$  are shown in Subsections 4.3, 4.4, and 4.5.

### 4.1. Classification at the Overall Criterion $G$

Table 4 shows the classification performed at the overall criterion  $G$ .

**Table 4.**  
Results of the ordinal classification.

| Candidate | Higher possible class    | Lower possible class     |
|-----------|--------------------------|--------------------------|
| $C_1$     | Not Acceptable           | Acceptable with training |
| $C_2$     | Not Acceptable           | Acceptable with training |
| $C_3$     | Acceptable with training | Excellent                |
| $C_4$     | Acceptable with training | Acceptable with training |
| $C_5$     | Acceptable with training | Acceptable with training |
| $C_6$     | Excellent                | Excellent                |
| $C_7$     | Acceptable with training | Excellent                |
| $C_8$     | Not Acceptable           | Not Acceptable           |
| $C_9$     | Excellent                | Excellent                |
| $C_{10}$  | Acceptable with training | Excellent                |
| $C_{11}$  | Acceptable with training | Excellent                |
| $C_{12}$  | Acceptable with training | Acceptable with training |
| $C_{13}$  | Acceptable with training | Excellent                |
| $C_{14}$  | Acceptable with training | Excellent                |
| $C_{15}$  | Excellent                | Excellent                |
| $C_{16}$  | Not Acceptable           | Not Acceptable           |
| $C_{17}$  | Not Acceptable           | Not Acceptable           |
| $C_{18}$  | Acceptable with training | Excellent                |
| $C_{19}$  | Not Acceptable           | Acceptable with training |
| $C_{20}$  | Acceptable with training | Acceptable with training |

From Table 4, it is clear that:

- 5 candidates were precisely assigned to the class “Acceptable with training”.
- 12 candidates were assigned to contiguous classes (e.g.,  $C_6$  can be assigned to “Not Acceptable” or “Acceptable with Training”).
- The method was basically not able to classify 3 candidates with the current information ( $C_8$ ,  $C_{16}$ ,  $C_{17}$ ).
- 6 candidates can be classified as Excellent.
- 12 candidates can be classified as Not Acceptable.

The fact that some candidates were precisely assigned to a single class indicates that the model can generate decisive classifications when the evaluation inputs are sufficiently clear, consistent, and dominant. However, evidently, there may be occasions where the methodology cannot provide a precise classification; when this is the case and more precision is required, the recommendation is to further involve the decision maker so they can provide more information that can lead to more precise results (see how, in the sensitivity analysis performed in the next section, there are more precise classifications). In any case, recall that precise classifications are not synonymous with better classification procedures.

There are 12 other candidates who were assigned to contiguous classes. This reflects uncertainty in at least one of the key evaluation criteria and can be seen as a desirable property of the model, since it can communicate uncertainty explicitly. Unlike traditional scoring models that obligatorily must collapse everything into a single class, the present approach allows decision-makers to recognize the risk of misclassification, apply complementary judgment, and request further evidence or validation, such as interviews, reference checks, or trial assignments, in cases where insufficient information was provided to the model.

Several candidates performed especially well on the technical competencies dimension ( $G_1$ ), which includes Quality Process ( $g_{11}$ ), Academic Process ( $g_{14}$ ), and Planning Process ( $g_{15}$ ). For instance,  $C_1$  demonstrated consistently high scores in Quality Process and Planning Process, which helped elevate their classification to the “Excellent” range in the higher bound.

Candidates such as  $C_3$ ,  $C_4$ , and  $C_5$  illustrate the case of balanced but moderate performers. These candidates were classified within the *Acceptable with training* category, without crossing into either “Excellent” or strictly “Not acceptable.” This group appears to represent candidates who meet baseline requirements across most competencies but lack standout performance in critical areas. For example,  $C_3$  showed adequate but not outstanding results on *Resource Management* ( $g_{12}$ ) and *Leadership* ( $g_{32}$ ), resulting in a classification that reflects adequacy but not excellence. These candidates would likely benefit from targeted development programs, mentoring in leadership skills, or structured opportunities to demonstrate strategic vision.

Another pattern is represented by candidates like  $C_6$ ,  $C_7$ ,  $C_{10}$ , and  $C_{11}$ , who oscillated between “Not acceptable” and “Acceptable with training”. Their profiles highlight deficiencies in essential managerial or interpersonal competencies. For example,  $C_6$  showed weaknesses in *Leadership* ( $g_{32}$ ) and *Teamwork* ( $g_{33}$ ) despite strong academic scores. Similarly,  $C_7$  combined strong performance in *Resource Management* ( $g_{12}$ ) with low evaluations in *Effective Communication* ( $g_{22}$ ) and *Leadership* ( $g_{32}$ ), leading to an uncertain classification outcome. These results reinforce the notion that deficiencies in interpersonal and managerial competencies can critically undermine otherwise solid technical or academic records, given the relational nature of leadership in higher education.

#### 4.2. Sensitivity Analysis

The most important matter that should be addressed regarding the parameter values of the model concerns the premise that all criteria are equally important. This assumption was adopted as a neutral starting point, which is common in multi-criteria decision-making. Under this setting, weights are distributed uniformly across the three groups of competencies (technical, managerial, and general), and within each group across their corresponding elementary criteria. Consequently, the classifications reflect a “balanced” perspective, where every criterion contributes equally to the decision-making process. However, the decision-maker perceived that certain competencies, such as strategic vision, leadership, or financial management, could become more critical than others. Therefore, a sensitivity analysis was performed. By progressively shifting from equal weights to more differentiated distributions such as those privileging managerial competencies ( $G_2$ ) or general competencies ( $G_3$ ), the robustness of candidate classifications can be tested. If candidates remain in the same class across different weighting schemes, their evaluation can be considered stable and reliable. Conversely, if their classification changes substantially when weights are adjusted, this indicates sensitivity and highlights the need for careful discussion among decision-makers regarding the true relative importance of each competency domain.

Table 5 presents the interval weights assigned to criteria under three different scenarios considered in the sensitivity analysis: near-equal distribution, moderately unequal distribution, and strongly unequal distribution. These scenarios were designed to examine how variations in the relative importance of criteria affect the overall classification of candidates. The near-equal scenario maintains weights close to uniformity, the moderately unequal scenario introduces slight deviations to reflect differentiated importance, and the strongly unequal scenario emphasizes specific criteria more heavily.

**Table 5.**  
Sensitivity analysis of weight assignments.

| Criterion | Near Equal  | Moderately Unequal | Strongly Unequal |
|-----------|-------------|--------------------|------------------|
| $g_{11}$  | [0.32,0.34] | [0.3,0.4]          | [0.4,0.4]        |
| $g_{12}$  | [0.32,0.34] | [0.25,0.35]        | [0.35,0.35]      |
| $g_{13}$  | [0.32,0.34] | [0.2,0.35]         | [0.25,0.25]      |
| $g_{14}$  | [0.19,0.21] | [0.15,0.25]        | [0.25,0.25]      |
| $g_{15}$  | [0.19,0.21] | [0.1,0.2]          | [0.2,0.2]        |
| $g_{21}$  | [0.19,0.21] | [0.1,0.2]          | [0.15,0.15]      |
| $g_{22}$  | [0.19,0.21] | [0.2,0.3]          | [0.2,0.2]        |
| $g_{23}$  | [0.19,0.21] | [0.15,0.2]         | [0.2,0.2]        |
| $g_{24}$  | [0.24,0.26] | [0.25,0.3]         | [0.3,0.3]        |
| $g_{31}$  | [0.24,0.26] | [0.2,0.3]          | [0.25,0.25]      |
| $g_{32}$  | [0.24,0.26] | [0.2,0.25]         | [0.25,0.25]      |
| $g_{33}$  | [0.24,0.26] | [0.15,0.2]         | [0.2,0.2]        |
| $g_{34}$  | [0.16,0.18] | [0.1,0.15]         | [0.1,0.1]        |
| $g_{35}$  | [0.16,0.18] | [0.15,0.2]         | [0.2,0.2]        |
| $g_{36}$  | [0.16,0.18] | [0.1,0.25]         | [0.15,0.15]      |
| $g_{11}$  | [0.16,0.18] | [0.15,0.2]         | [0.2,0.2]        |
| $g_{12}$  | [0.16,0.18] | [0.1,0.15]         | [0.15,0.15]      |
| $g_{13}$  | [0.16,0.18] | [0.15,0.3]         | [0.2,0.2]        |

The classification of the candidates when using the weights in Table 5 is shown in Table 6 (NA → Not Acceptable; AT → Acceptable with training; EX → Excellent).

**Table 6.**  
Results of the sensitivity analysis for the weight assignments.

| Candidate | Near Equal | Moderately Unequal | Strongly Unequal |
|-----------|------------|--------------------|------------------|
| $C_1$     | AT-EX      | AT-EX              | AT-EX            |
| $C_2$     | AT-AT      | AT-AT              | NA-EX            |
| $C_3$     | NA-AT      | NA-NA              | NA-AT            |
| $C_4$     | AT-AT      | AT-AT              | AT-AT            |
| $C_5$     | AT-AT      | AT-AT              | AT-AT            |
| $C_6$     | NA-NA      | NA-AT              | NA-AT            |
| $C_7$     | NA-AT      | NA-AT              | NA-EX            |
| $C_8$     | AT-AT      | AT-AT              | NA-AT            |
| $C_9$     | NA-AT      | AT-AT              | NA-AT            |
| $C_{10}$  | NA-AT      | NA-AT              | NA-AT            |
| $C_{11}$  | AT-AT      | NA-AT              | NA-AT            |
| $C_{12}$  | NA-AT      | AT-AT              | NA-AT            |
| $C_{13}$  | NA-AT      | AT-AT              | NA-AT            |
| $C_{14}$  | NA-AT      | AT-AT              | NA-AT            |
| $C_{15}$  | AT-AT      | AT-AT              | AT-EX            |
| $C_{16}$  | AT-AT      | AT-EX              | AT-EX            |
| $C_{17}$  | NA-AT      | AT-AT              | NA-AT            |
| $C_{18}$  | NA-AT      | NA-AT              | NA-EX            |
| $C_{19}$  | AT-EX      | AT-EX              | AT-AT            |
| $C_{20}$  | AT-AT      | AT-AT              | AT-AT            |

From Table 6, we can make some interesting remarks.  $C_1$  remains robust: across sensitivity scenarios, it reaches Excellent consistently. Its profile confirms resilience with strong upward potential.  $C_2$ , however, shows more variability. In the strongly unequal scenario, it spans from Not acceptable to Excellent, signaling sensitivity to weight distributions. While it was originally assigned to AT-EX, sensitivity shows that  $C_2$ 's success depends heavily on whether technical or managerial competencies are emphasized.

$C_{20}$  was originally assigned to AT–EX, but under sensitivity analysis, it stabilizes as AT–AT across all scenarios. This indicates that while  $C_{20}$  appeared to be an "excellent candidate" under equal weights, its upward potential diminishes once differentiated importance is considered. Sensitivity analysis downgrades  $C_{20}$  to a stable but middle-range candidate.

The analysis exposed some candidates as sensitive:  $C_8$ ,  $C_{15}$ ,  $C_{16}$ , and  $C_{18}$ .  $C_8$  was originally volatile, ranging from NA to EX, but sensitivity reveals a much narrower profile: mostly AT–AT, except in the strongly unequal scenario where it drops to NA–AT. This indicates that  $C_8$ 's excellence in the original model was likely an artifact of equal weights, and with more preference information, the candidate is capped at Acceptable with training.  $C_{15}$ , originally assigned to NA–AT, reaches AT–EX in sensitivity. In the case of Candidate 16, originally assigned to NA–EX, it consistently performs well in sensitivity, moving from AT–AT to AT–EX in multiple scenarios. This confirms that  $C_{16}$  is a high-potential but sensitive candidate, whose strengths are highlighted when managerial competencies are emphasized. Finally,  $C_{18}$ , originally assigned to NA–AT, reaches NA–EX in the strongly unequal scenario during sensitivity analysis.

#### 4.3. Classification Considering Only Technical Competencies, $G_1$

Technical competencies are foundational to the administrative and operational performance of a university director. Evaluating the 20 candidates using only these criteria isolates the importance of technical-operational proficiency and allows us to assess how dependent overall classification is on other types of competencies (managerial and general). The results are shown in Table 7.

**Table 7.**  
Classification at  $G_1$  level.

| Candidate | Lower possible class     | Higher possible class    |
|-----------|--------------------------|--------------------------|
| $C_1$     | Not Acceptable           | Acceptable with training |
| $C_2$     | Acceptable with training | Excellent                |
| $C_3$     | Acceptable with training | Excellent                |
| $C_4$     | Acceptable with training | Acceptable with training |
| $C_5$     | Acceptable with training | Acceptable with training |
| $C_6$     | Not Acceptable           | Acceptable with training |
| $C_7$     | Not Acceptable           | Acceptable with training |
| $C_8$     | Excellent                | Excellent                |
| $C_9$     | Acceptable with training | Excellent                |
| $C_{10}$  | Acceptable with training | Excellent                |
| $C_{11}$  | Acceptable with training | Acceptable with training |
| $C_{12}$  | Not Acceptable           | Not Acceptable           |
| $C_{13}$  | Acceptable with training | Excellent                |
| $C_{14}$  | Acceptable with training | Excellent                |
| $C_{15}$  | Acceptable with training | Excellent                |
| $C_{16}$  | Acceptable with training | Excellent                |
| $C_{17}$  | Not Acceptable           | Not Acceptable           |
| $C_{18}$  | Acceptable with training | Excellent                |
| $C_{19}$  | Acceptable with training | Excellent                |
| $C_{20}$  | Acceptable with training | Acceptable with training |

Considering only the criteria regarding technical competencies, 6 candidates were precisely assigned (i.e., the same class as minimum and maximum). 14 candidates were assigned to two contiguous classes, mostly between "Acceptable with training" and "Excellent." None were assigned to a class range wider than two.

The  $G_1$ -based model produced a few higher classifications than the full model. Specifically:

- $C_3$ ,  $C_8$ , and  $C_{16}$  were classified as Excellent under  $G_1$ -only but were previously classified as *Acceptable with training* (or even *Not Acceptable* in the full model).

- $C_{12}$ , the only candidate rated as *Not Acceptable*, previously had more favorable ranges.

This suggests that many candidates perform better on technical competencies than on managerial and general ones.

#### 4.4. Classification Based on Managerial Competencies, $G_2$

The classification results at the  $G_2$  (managerial competencies) level, which include strategic vision ( $g_{21}$ ), effective communication ( $g_{22}$ ), negotiation ( $g_{23}$ ), and effective relationship network ( $g_{24}$ ), show some interesting patterns about how candidates are positioned when leadership evaluation only looks at these skills. Table 8 shows the classification that was done at this level.

**Table 8.**  
Classification at  $G_2$  level.

| Candidate | Lower possible class     | Higher possible class    |
|-----------|--------------------------|--------------------------|
| $C_1$     | Not Acceptable           | Acceptable with training |
| $C_2$     | Not Acceptable           | Acceptable with training |
| $C_3$     | Acceptable with training | Excellent                |
| $C_4$     | Acceptable with training | Excellent                |
| $C_5$     | Not Acceptable           | Acceptable with training |
| $C_6$     | Acceptable with training | Excellent                |
| $C_7$     | Excellent                | Excellent                |
| $C_8$     | Not Acceptable           | Excellent                |
| $C_9$     | Not Acceptable           | Excellent                |
| $C_{10}$  | Acceptable with training | Excellent                |
| $C_{11}$  | Acceptable with training | Acceptable with training |
| $C_{12}$  | Acceptable with training | Excellent                |
| $C_{13}$  | Acceptable with training | Excellent                |
| $C_{14}$  | Acceptable with training | Excellent                |
| $C_{15}$  | Acceptable with training | Excellent                |
| $C_{16}$  | Not Acceptable           | Excellent                |
| $C_{17}$  | Acceptable with training | Excellent                |
| $C_{18}$  | Not Acceptable           | Acceptable with training |
| $C_{19}$  | Not Acceptable           | Acceptable with training |
| $C_{20}$  | Acceptable with training | Excellent                |

From Table 8, we can see that the distribution suggests that managerial competencies alone tend to polarize candidates more sharply into “Not Acceptable” or “Potentially Excellent with training” categories, leaving fewer in a safe “Excellent” zone.  $C_7$  stands out as the only candidate classified as Excellent without ambiguity. This implies a robust profile across all four  $G_2$  sub criteria, scoring consistently at or above the  $r_{3,1}$  thresholds (Table 2). Many candidates, like  $C_3$ ,  $C_6$ ,  $C_{10}$ ,  $C_{12}$ ,  $C_{13}$ ,  $C_{14}$ ,  $C_{15}$ , and  $C_{20}$ , reached Excellent as their highest possible class, but with uncertainty, indicating that they meet or exceed high standards in certain managerial competencies but are borderline in others. Particularly,  $C_8$ ,  $C_9$ , and  $C_{16}$  were assigned with the widest range of classes; this indicates that the methodology does not have sufficient information for a more precise classification, and further information (e.g., preferential information) can be provided.

#### 4.5. Classification Considering Only General Competencies, $G_3$

The results of the classification at this level are shown in Table 9

**Table 9.**  
Classification at  $G_3$  level.

| Candidate | Lower possible class     | Higher possible class    |
|-----------|--------------------------|--------------------------|
| $C_1$     | Not Acceptable           | Excellent                |
| $C_2$     | Not Acceptable           | Excellent                |
| $C_3$     | Not Acceptable           | Excellent                |
| $C_4$     | Acceptable with training | Acceptable with training |
| $C_5$     | Acceptable with training | Acceptable with training |
| $C_6$     | Acceptable with training | Excellent                |
| $C_7$     | Acceptable with training | Excellent                |
| $C_8$     | Not Acceptable           | Acceptable with training |
| $C_9$     | Acceptable with training | Excellent                |
| $C_{10}$  | Not Acceptable           | Acceptable with training |
| $C_{11}$  | Acceptable with training | Excellent                |
| $C_{12}$  | Acceptable with training | Excellent                |
| $C_{13}$  | Acceptable with training | Excellent                |
| $C_{14}$  | Not Acceptable           | Excellent                |
| $C_{15}$  | Acceptable with training | Excellent                |
| $C_{16}$  | Not Acceptable           | Excellent                |
| $C_{17}$  | Not Acceptable           | Excellent                |
| $C_{18}$  | Acceptable with training | Excellent                |
| $C_{19}$  | Not Acceptable           | Acceptable with training |
| $C_{20}$  | Not Acceptable           | Excellent                |

The classification results obtained using exclusively the  $G_3$  criteria (i.e., Human development ( $g_{3,1}$ ), Leadership ( $g_{3,2}$ ), Teamwork ( $g_{3,3}$ ), Service quality and attitude ( $g_{3,4}$ ), High performance ( $g_{3,5}$ ), and Knowledge of TecNM and public administration ( $g_{3,6}$ ) offer interesting insights into how general competencies influence the overall evaluation of director candidates.

From the results, we can see three distinct patterns:

- Candidates with the highest classification of Excellent: A significant group of candidates (e.g.,  $C_1$ ,  $C_2$ ,  $C_3$ ,  $C_6$ ,  $C_7$ ,  $C_9$ ,  $C_{12}$ ,  $C_{13}$ ,  $C_{14}$ ,  $C_{15}$ ,  $C_{16}$ ,  $C_{17}$ ,  $C_{18}$ ,  $C_{20}$ ) reached "Excellent" as their upper bound. This indicates that these candidates possess strong general skills, even if their other skill groups ( $G_1$  or  $G_2$ ) are not as developed.

Several significant variations become apparent when compared with the classification based on the technical competence criterion ( $G_1$ ).

- In  $G_1$ , many candidates had shorter class intervals, usually just one or two classes next to each other. In  $G_3$ , on the other hand, intervals often range from "Not Acceptable" to "Excellent". This demonstrates that general competencies ( $G_3$ ) lead to a broader spectrum of perceived acceptability.
- Results show that more candidates reached an "Excellent" upper bound than  $G_1$ , even for people who did not perform as well in technical areas. This indicates that general skills can compensate for poor technical performance in the eyes of examiners.
- $G_3$  also results in a greater number of candidates receiving "Not Acceptable" as the minimum score, suggesting that weaknesses in general competences are regarded as more harmful than shortcomings in technical or managerial skills ( $G_1$  or  $G_2$ ). This is in line with what leadership jobs are all about: they need people skills, leadership abilities, and understanding of the organization.

## 5. Conclusions

The creation and use of a structured multi-criteria decision-making (MCDA) model to choose university directors has provided us with valuable information on both the process of assessing leaders and the quality of the available candidates. Through the proposed model, decision-makers benefit from a transparent, evidence-based methodology that mitigates the limitations of traditional, often informal,

selection mechanisms, while also demonstrating the capacity of such models to identify strengths, weaknesses, and developmental needs across candidates.

One of the main outcomes of this work is the ability of the MCDA approach to strengthen objectivity in candidate classification. By relying on clearly defined criteria (i.e., technical, managerial, and general competencies), the process avoids overdependence on subjective judgment, political pressures, or institutional traditions. Instead, candidates are systematically compared against reference profiles representing the classes “Excellent,” “Acceptable with training,” and “Not Acceptable.” Moreover, using interval theory to represent vagueness and imprecision allows the model to handle uncertainty that is inherent to human judgments. This uncertainty arises from the ambiguity faced by decision-makers in real scenarios and helps to capture nuanced differences between candidates.

The qualitative research conducted here demonstrated that the queried individuals are categorized based on three groups of skills: technical, managerial, and general competencies. Technical competencies generally resulted in more restrictive classifications, indicative of the rigorous nature of criteria such as planning, academic process management, and resource administration. This indicates that technical proficiency serves as an essential criterion for differentiating adequately prepared applicants from those who need more extensive training. In contrast, managerial competencies were more permissive, with many candidates reaching at least the “Acceptable with training” class. This suggests that attributes like communication, negotiation, and relationship-building are more evenly distributed across the candidate pool, though excellence in these domains still distinguishes top performers. General competencies, such as teamwork, leadership, and service attitude, showed the greatest variation. They allow many people to move up in classification, which indicates that interpersonal and organizational abilities are common but also key to finding excellence.

The classification results from the case study show that the three classes are not all the same. A significant number of candidates attained the “Excellent” designation, signifying that the institution has access to individuals who already exhibit high levels of proficiency in essential areas such as strategic vision, leadership, teamwork, and quality assurance processes. These individuals are suitable, immediate choices for taking on leadership roles without any additional training. At the same time, many candidates were placed in the “Acceptable with training” group. This finding indicates that the model can identify promising individuals who do not yet meet the standards for excellence but could reach those standards with appropriate professional development. This group represents a practical reserve of future leaders. Investing in training for these individuals could strengthen the institution’s long-term leadership pipeline, ensuring that future leadership transitions are sustainable and adaptable. Lastly, the fact that some candidates are labeled as “Not Acceptable” demonstrates the methodology’s discriminating nature. Instead of treating all candidates as potentially suitable, the method clearly indicates which candidates are not yet ready for leadership roles. This approach helps decision-makers avoid costly mistakes by hiring individuals lacking the necessary skills and provides these candidates with valuable feedback on areas for improvement.

In addition to its practical implications, this study enhances methodological understanding by demonstrating the adaptability of MCDA methodologies, namely interval-based assessments, to intricate human resource evaluation challenges. These methodologies have been extensively utilized in engineering, logistics, and environmental management; however, their application to leadership evaluation in higher education is still innovative. The model’s capacity to synthesize many viewpoints, embrace ambiguity, and generate sophisticated classifications renders it a significant enhancement to the arsenal of institutional governance.

It is also important to acknowledge the limitations of this work. The candidates, though representative, do not fully capture the variability and complexity of all real-world aspirants. Future research should test the model with more candidate data to confirm its robustness in practice. Additionally, while the study used three classes of reference profiles provided by the queried decision-makers, expanding to more finely graded categories (e.g., “Outstanding,” “Very Good,” “Marginal,” etc.) could offer richer differentiation. Another avenue for development involves incorporating dynamic

feedback loops, where candidates' performance over time can be re-evaluated and updated in the model, thus linking selection with continuous professional development.

### Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

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