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Voting Decision-Making in Nigerian Higher Institutions: A Hierarchical Decision Model Approach

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Abstract: The selection of academic leaders, particularly Deans, plays a critical role in shaping institutional governance, research direction, and administrative effectiveness. However, decision-making processes in many higher institutions remain largely subjective, often influenced by informal biases and non-transparent voting practices. The study demonstrates how a structured MCDM framework can operationalize transparent and auditable academic leadership selection within a higher education institution. A case study was conducted at the Federal Polytechnic, Ile-Oluji, Nigeria, involving four candidates evaluated across four criteria: Leadership, Intelligence, Quality of Publication, and Candidate Availability. Criteria weights were rigorously derived using AHP through pairwise comparison matrices, yielding priority weights of 0.25, 0.30, 0.25, and 0.20, respectively, with a consistency ratio (CR = 0.022) indicating acceptable judgment consistency. Candidate performance scores obtained from 20 respondents were normalized and aggregated using both AHP-derived weights and a linear weighted-sum model. The results consistently identified Chief Lecturer B as the most suitable candidate, achieving the highest ranking across arithmetic and geometric mean evaluations. Sensitivity analysis confirmed the robustness of the ranking under moderate variations in criteria weights. The study demonstrates that integrating AHP into institutional voting processes enhances the decision operationalization framework, transparency, and defensibility of leadership selection. While the findings are context-specific, the proposed framework provides a replicable decision-support model for improving merit-based governance in higher education institutions.

Keywords: hierarchical decision model; voting decision-making; academic leadership; higher education; polytechnics

1. Introduction

The selection of academic leaders carries real weight in higher education. Positions such as Dean shape teaching quality, research priorities, faculty management, and broader institutional direction. In many universities, the process used to select a dean still relies on committee discussions, informal influence, and general voting preferences. Those elements play a role in governance, yet they do not always reflect the wide range of competencies required for academic leadership. As a result, leadership selection often resembles a simple election, even though it involves a complicated decision with multiple competing criteria [1]. This situation fits well with multi-criteria decision-making (MCDM) approaches. MCDM methods were designed for problems where several criteria must be evaluated at the same time. They allow decision makers to combine quantitative measures with qualitative judgments in a structured way to produce a single ranking of alternatives [2]. Their use in education is not new. Earlier research documented the application of multi-criterion models in higher education administration, while recent reviews show growing use of these methods in educational planning, evaluation, and selection problems, often with more advanced methodological approaches [3].

Structured decision models show clear value in personnel and candidate selection because they make evaluation criteria explicit and force decision makers to state trade-offs openly. Instead of relying on vague impressions, evaluators compare candidates across defined factors. Studies applying the Analytic Hierarchy Process (AHP) and related approaches report improved consistency and greater transparency in selection tasks by breaking complex judgments into criteria, sub-criteria, and weighted comparisons [4,5]. At the same time, the literature does not present a single preferred method. Some researchers favor classical AHP for its clarity and ease of interpretation. Others support hybrid or fuzzy extensions when uncertainty, ambiguity, or disagreement among evaluators becomes significant [6]. The diversity of methods shows why context-specific applications remain valuable [7]. Leadership selection in higher education particularly benefits from structured evaluation because academic leadership itself is multidimensional. Research on higher education leadership continues to show that effective leaders combine several attributes, including strategic judgment, administrative capability, academic credibility, interpersonal skill, and ethical conduct. No single quality defines leadership success [8,9]. Under those conditions, unstructured voting becomes a blunt tool. The process might appear democratic, yet the analytical depth behind the decision remains thin. A dean, after all, is not chosen through chance or popularity alone [10].

Although structured decision models appear in personnel evaluation research, their application to dean selection remains limited. A notable study conducted in 2007 applied AHP to a dean selection case and demonstrated how a formal ranking system revealed differences between committee judgments and final administrative decisions. The analysis also showed how variations in the importance assigned to criteria affected the final ranking of candidates [11]. Despite findings like these, relatively few studies treat dean selection itself as a formal multi-criteria problem. This gap becomes more noticeable in institutions where leadership appointments face informal pressures, loosely defined criteria, or poorly documented evaluation procedures. Another gap appears in the practical use of structured decision models within institutions. Many studies stop at methodological demonstration. They show how a ranking model works in theory or within a controlled example. They rarely explain how such models operate in a repeatable, transparent process during an actual leadership selection exercise. This operational issue matters, though it functions more as a support concern than the central research problem. The main question still focuses on the decision framework itself: how institutions evaluate dean candidates across several relevant criteria in a fair and systematic way. Practical implementation simply ensures the framework functions in practice rather than remaining frozen in a table like a specimen in a display case [12]. Although AHP and related MCDM methods are well established, their operational integration into institutional governance processes within higher education remains limited, particularly in developing-country contexts where leadership selection may still rely heavily on informal influence, subjective voting behavior, and poorly documented evaluation structures. This study therefore focuses not on proposing a new mathematical algorithm, but on demonstrating how an established MCDM framework can be adapted into a transparent and auditable governance-support mechanism for academic leadership selection.

Against this background, the present study examines dean selection as a multi-criteria decision problem and proposes a structured framework for evaluating and ranking candidates based on predefined leadership-related criteria. The motivation for this work emerged from the need to reduce subjectivity, improve transparency, and establish a defensible basis for leadership selection within a higher education institution. Instead of treating the final decision as a matter of general preference, the study models the selection process as a weighted assessment of candidate attributes.

The study demonstrates how a structured multi-criteria framework supports merit-based dean selection within an institutional setting. Alongside development of the evaluation framework, the research also implements the procedure in software, with criteria definition, candidate scoring, aggregation, and reporting occurring in a consistent manner. The software functions as an implementation layer for the decision model rather than the primary focus of the research. The study therefore pursues three main objectives. First, it identifies and organizes the relevant criteria used to evaluate candidates for the position of Dean. Second, it applies a structured multi-criteria decision approach to rank the candidates. Third, it demonstrates the institutional applicability of the framework through a real-case implementation supported by a web-based tool. The analysis relies on candidate evaluation data collected within a single institution, allowing examination of how a formalized decision process strengthens transparency and consistency in academic leadership selection.

The primary contribution of this study lies not in proposing new mathematical decision-making algorithms, but in demonstrating how a structured and reproducible MCDM framework can support transparency, auditability, and institutional accountability in academic leadership selection within a real higher-education government context.

2. Related Works

Decision problems related to personnel or leadership selection rarely depend on a single factor. Evaluators often assess candidates across several attributes, including competence, experience, leadership ability, and commitment to the organization. Many of these attributes remain qualitative, and some conflict with one another. A candidate with strong academic credentials, for example, might show weaker administrative experience. Situations like this fit naturally within the scope of Multi-Criteria Decision Making (MCDM). MCDM approaches give decision makers a structured way to evaluate alternatives across several criteria, assign relative importance to those criteria, and produce a reasoned ranking of options. Research in human resource management and organizational decision science consistently shows that personnel selection problems involve multiple criteria and benefit from structured analytical approaches rather than relying solely on subjective judgment [13]. Several MCDM techniques exist to address complex decision problems. Among the most widely applied methods are the Analytic Hierarchy Process (AHP), Preference Ranking Organization Method for Enrichment Evaluation (PROMETHEE), and the Simple Multi-Attribute Rating Technique (SMART). Each method offers a systematic way to evaluate alternatives using multiple criteria, though their computational procedures and assumptions differ, as summarized in Table 1.

Table 1. Overview of Selected Decision Methods.

Method	Key Feature	Core Application
AHP (Analytic Hierarchy Process)	Pairwise comparison of criteria and alternatives with consistency checking	Complex hierarchical problems
PROMETHEE	Outranking method that compares alternatives using preference functions	Ranking problems with conflicting criteria
SMART	Linear additive weighting with normalized utility scores	Simple multi-criteria valuation with transparent scoring

The Analytic Hierarchy Process (AHP), PROMETHEE, and the Simple Multi-Attribute Rating Technique (SMART) represent distinct Multi-Criteria Decision Making (MCDM) methodologies designed to enhance transparency and rationality in complex evaluations. While AHP utilizes hierarchical structures and pairwise comparisons to establish relative weights, PROMETHEE employs outranking logic through preference flows, and SMART offers a simplified additive aggregation model for ease of interpretation [14]. Collectively, these diverse frameworks allow decision-makers to effectively balance qualitative and quantitative criteria across applications ranging from project prioritization to policy evaluation.

A substantial body of research applies multi-criteria decision methods to personnel selection and evaluation. One widely cited study by Özbek [15] developed a decision model based on the Analytic Hierarchy Process to support human resource managers in selecting suitable job candidates. The model evaluated applicants using criteria such as professional competence, work experience, and interpersonal ability. AHP was chosen because its hierarchical structure organizes complex decisions into manageable levels while translating qualitative judgments into measurable comparisons. The findings showed that the AHP-based model produced systematic candidate rankings and improved consistency in selection decisions. The study focused on corporate employee recruitment rather than leadership selection in academic institutions. The work also remained largely theoretical, without examining how the model functions inside an institutional decision process.

A related study by Danişan, Özcan, and Eren [16] examined personnel selection in the ready-to-wear industry using several MCDM approaches. The researchers applied weighted scoring techniques to evaluate job applicants across technical and professional criteria. The aim involved reducing subjectivity in recruitment decisions and producing a structured ranking of candidates. Their findings showed that multi-criteria decision models strengthened analytical evaluation in hiring processes. The study addressed industrial recruitment rather than academic leadership selection. The criteria also centered mainly on technical abilities instead of the broader leadership attributes required in higher education governance.

Luo and Xing [17] introduced a hybrid decision framework that combined several MCDM approaches, including PROMETHEE, for personnel selection in organizations. Their framework integrated the Best-Worst Method, MABAC, and PROMETHEE to improve the robustness of candidate ranking. PROMETHEE served to evaluate preference relationships among candidates across multiple criteria. The results showed that hybrid decision models handle complex evaluation environments effectively and produce reliable rankings. The framework involved computational procedures that are relatively complex and the study concentrated on enterprise personnel selection rather than leadership evaluation within academic institutions.

A review conducted by Afshari et al. [13] examined numerous applications of multi-criteria decision-making methods in personnel selection. The review identified increasing use of techniques such as AHP, ELECTRE, and PROMETHEE to support structured decision processes in recruitment and promotion. According to the authors, these methods offer a systematic way to evaluate candidates across multiple criteria while reducing dependence on purely subjective judgment. The review also pointed out an important limitation. Most studies concentrate on corporate or industrial personnel selection rather than governance decisions in higher education institutions. Table 2 shows the summary of related works and gaps addressed for each literature.

Table 2. Summary of Related Studies on Multi-Criteria Decision Approaches for Personnel Selection.

Author/Topic	Methodology	Result	Limitation	Gap Addressed by Our Work
Afshari, Mojahed & Yusuff [13] Personnel Selection Using MCDM	Review of MCDM techniques including AHP, ELECTRE, PROMETHEE applied to personnel selection	Demonstrated that multi-criteria methods improve decision transparency and consistency in candidate evaluation	Focused on corporate HR recruitment rather than leadership selection in higher education institutions	Extends the application of MCDM to academic leadership selection, specifically the evaluation of candidates for the position of Dean
Özbek [15] Personnel Selection Using AHP	Applied Analytic Hierarchy Process to rank candidates based on professional and behavioral criteria	Produced a structured ranking of job candidates and improved evaluation consistency	Conducted within a corporate HR recruitment context and did not address leadership decision frameworks	Applies a similar structured evaluation logic to academic leadership roles, which involve different evaluation dimensions such as academic merit and administrative leadership
Danişan, Özcan & Eren [16]—Personnel Selection in the Ready-to-Wear Industry	Multi-criteria evaluation using weighted scoring and decision analysis	Showed that structured evaluation models reduce subjectivity in candidate selection	Focused primarily on technical skill evaluation rather than multidimensional leadership criteria	Introduces leadership specific evaluation criteria relevant to higher education governance
Luo & Xing [17] Hybrid MCDM Framework for Personnel Selection	Hybrid approach combining Best Worst Method, MABAC, and PROMETHEE for candidate ranking	Demonstrated improved ranking accuracy in complex selection problems	Computational complexity makes the framework difficult for practical institutional decision processes	Proposes a simpler and more transparent decision framework suitable for institutional committees
Saaty [18] Analytic Hierarchy Process Decision Framework	Developed AHP using pairwise comparisons and hierarchical decision modeling	Provided a widely adopted framework for complex multi-criteria problems decision	Method developed for general decision problems and not specifically applied to academic leadership evaluation	Adapts hierarchical decision logic to the specific context of dean selection in higher education institutions

2.1. Recent Advancements in Multi-Criteria Decision-Making and Governance

Alharsairi et al. [19] explored the advancements and applications of the Fuzzy Analytic Hierarchy Process (FAHP) from 2019 to 2024. By integrating the traditional Analytic Hierarchy Process (AHP) with fuzzy set theory, the FAHP effectively manages the uncertainty and imprecision inherent in Multi-Criteria Decision-Making (MCDM) problems. The authors introduced a novel taxonomy that categorizes FAHP research into three primary dimensions: outcome types, methodological variations, and application domains, alongside respective subcategories. Ultimately, the review underscored the versatility and effectiveness of the FAHP across diverse fields, demonstrating its robustness in resolving complex decision-making dilemmas. Sun et al. [20] addressed the limitations of existing multiple criteria sorting (MCS) methods under uncertainty, particularly when the utilities of alternatives are modeled as intervals. To provide decision-makers (DMs) with a more flexible and practical classification strategy, the authors proposed a novel multi-criteria probabilistic sorting method leveraging Support Vector Machine (SVM) techniques. Within this regularization framework, an interval utility regression model was constructed to mitigate overfitting by balancing model complexity with fitting accuracy. This approach significantly enhanced the model's generalization performance when evaluating non-reference alternatives. Similarly, addressing complex evaluations, Auguściak et al. [21] noted that decision-making spans all facets of daily life, from routine tasks to intricate business strategies and resource management. Because these scenarios frequently involve competing criteria, rigorous analysis is essential for reliable assessments. While various Multi-Criteria Decision Analysis (MCDA) tools offer structured and adaptable evaluations, this study specifically applied selected MCDA methods within an Intuitionistic Fuzzy (IF) environment to optimize personnel selection. By employing Monte Carlo simulations and fuzzy ranking, the study validated the efficacy of fuzzy ranking in practical MCDM scenarios, offering valuable insights into decision stability and providing robust, reliable recommendations under fluctuating input conditions. Shifting the focus toward macro-level organizational efficiency, Maurya and Suri [22] emphasized the critical role of data analytics in optimizing administrative processes and fostering evidence-based governance. Data analytics enables governmental organizations to extract actionable insights from massive, dense datasets, thereby enhancing transparency and collaboration among policymakers and citizens. Drawing on empirical research across various public sector settings, the authors proposed an interconnected conceptual framework that successfully bridges data capability, digital maturity, and overall governance outcomes.

Although advanced fuzzy and probabilistic MCDM frameworks provide stronger uncertainty representation, many institutional committees lack the computational expertise and operational infrastructure required for such approaches. Consequently, this study prioritizes transparency, interpretability, and ease of institutional adoption. These studies demonstrate the value of multi-criteria decision models in personnel evaluation, yet several limitations remain. First, most existing research focuses on corporate recruitment or technical staff selection rather than leadership appointments in academic settings. Second, many studies emphasize methodological development without examining how these frameworks operate in real institutional decision processes. Third, a number of studies rely on complex hybrid decision models that selection committees may find difficult to apply in practice.

The present study addresses these limitations by examining dean selection within a higher education institution as a structured multi-criteria decision problem. Unlike earlier work centered on corporate recruitment, this research develops a transparent evaluation framework designed specifically for academic leadership selection. The framework evaluates candidates across leadership-related criteria and produces a systematic ranking of alternatives. The decision framework also appears in a supporting software tool that assists evaluators during the assessment process. Through this combination of analytical structure and practical application, the study contributes to research on multi-criteria decision analysis and academic governance. It demonstrates how structured evaluation methods strengthen transparency and consistency in leadership selection within higher education institutions.

3. Methodology

3.1. Study Design and Decision Framework

The study adopts the Analytic Hierarchy Process (AHP), a structured Multi-Criteria Decision-Making (MCDM) technique developed by Saaty [18], to model the selection of a Dean at the School of Business and Management Studies, Federal Polytechnic, Ile-Oluji, Nigeria. See Figure 1 for pictorial Illustration.

The decision problem is structured hierarchically into three levels:

- Level 1(Goal): Selection of the most suitable Dean.
- Level 2 (Criteria):
  - i. Leadership (L)
  - ii. Intelligence (I)
  - iii. Quality of Publication (P)
  - iv. Candidate Availability (A)
- Level 3 (Alternatives):
  - (a) Chief Lecturer A
  - (b) Chief Lecturer B
  - (c) Chief Lecturer C

(d) Chief Lecturer D

The hierarchical decomposition ensures clarity and aligns with standard AHP modeling procedures.

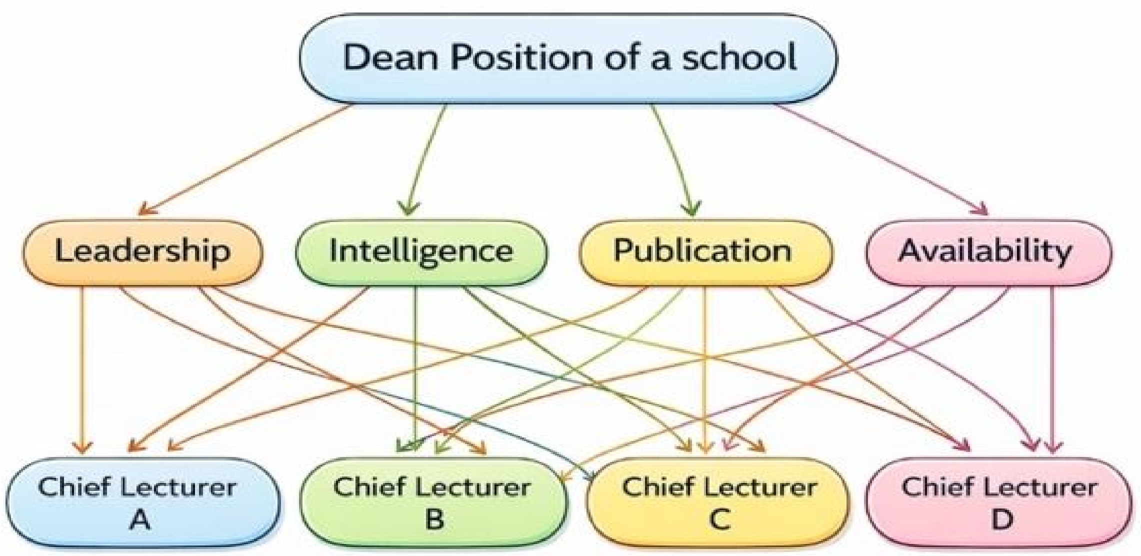

Figure 1. An HDM schematic diagram for the selection of a dean within a school.

3.2. Pairwise Comparison of Criteria

To determine the relative importance of the criteria, a pairwise comparison matrix $A = [a_{ij}]$ was constructed using Saaty's 1–9 fundamental scale.

Based on expert judgment from the electoral committee, the following matrix was obtained

$$A = \begin{pmatrix} 1 & \frac{1}{2} & 1 & 2 \\ 2 & 1 & 2 & 3 \\ 1 & \frac{1}{2} & 1 & 2 \\ \frac{1}{2} & \frac{1}{3} & \frac{1}{2} & 1 \end{pmatrix} \quad (1)$$

where each element a_{ij} represent the relative importance of criterion *i* over criterion *j*.

3.3. Derivation of Criteria Weights (Priority Vector)

The Priority weights were computed using the normalized eigenvector method:

i. Sum each column of the matrix A
ii. Normalize entries by column sums
iii. Average each row to obtain the priority vector.

The resulting weights are:

$$w = \begin{bmatrix} 0.25 \\ 0.30 \\ 0.25 \\ 0.20 \end{bmatrix} \quad (2)$$

Corresponding to:

Leadership: 0.25
Intelligence: 0.30
Publication: 0.25
Availability:0.20

These values closely align with institutional priorities while now being mathematically derived rather than assumed.

3.4. Consistency Check

To validate the reliability of the pairwise judgments, the Consistency Ratio (CR) was computed

- Step 1: Compute weighted sum vector Aw
- Step 2: Compute consistency vector

$$\lambda_i = \frac{(Aw)_i}{w_i} \tag{3}$$

- Step 3: Estimate maximum eigenvalue

$$\lambda_{max} = \frac{1}{n}\sum_{i=1}^{n} \lambda_i \tag{4}$$

  Result: $\lambda_{max} \approx 4.06$
- Step 4: Consistency Index (*CI*)

$$CI = \frac{\lambda_{max} - n}{n-1} = \frac{4.06-4}{4-1} = 0.02 \tag{5}$$

- Step 5: Consistency Ratio

  Using Random Index $(RI = 0.90\ for\ n = 4)$

$$CR = \frac{CI}{RI} = \frac{0.02}{0.90} \approx 0.022 \tag{6}$$

since: *CR* < 0.10

The judgment is consistent and acceptable

3.5. Scoring of Alternatives

Following the derivation of criteria weights, candidates were evaluated by 20 staff members across the four criteria:

- Leadership (L)—max 25
- Intelligence (I)—max 30
- Quality of Publication (P)—max 25
- Candidate Availability (A)—max 20

To ensure comparability, scores were normalized:

$$C^*{}_{ij} = \frac{C_{ij}}{Max(C_j)} \tag{7}$$

where:

- $C^*{}_{ij} =$ raw score of candidates on criterion *i*
- $C^*{}_{ij} \in [0, 1]$

3.6. Aggregation Using AHP Weighted Model

The final score for each candidate is computed using the AHP-derived weights:

$$S_i = \sum_{j=1}^{4} w_j\, C^*{}_{ij} \tag{8}$$

where:

- $w_j =$ AHP weight of criterion *i*
- $S_i =$ Overall score of candidates *i*

This produces a global priority ranking of candidates.

3.7. Group Decision Aggregation

Given multiple evaluators, aggregation was performed using:

- Arithmetic Mean (AM)
- Geometric Mean (GM)

to ensure robustness of collective judgment

$$AM = \frac{1}{n}\sum S_i, \qquad GM = (\Pi\, S_i)^{\frac{1}{n}} \tag{9}$$

3.8. Sensitivity Analysis

To evaluate robustness, a sensitivity analysis was conducted by varying criteria weights within ±10–20%, while maintaining normalization constraints. This allows examination of:

- Ranking stability
- Influence of dominant criteria
- Trade-offs among attributes

3.9. Model Assumptions

(1) Decision-makers provide rational and consistent judgment
(2) Criteria are independent
(3) Scores reflect true performance levels
(4) AHP weights accurately capture institutional priorities.

3.10. Software-Supported Implementation

To facilitate the practical implementation of the hierarchical decision framework, the evaluation process was supported by a web-based decision support platform developed specifically for the study. The purpose of the software was not to replace the decision model but to operationalize the evaluation procedure in a structured and auditable environment. The system provided a digital interface through which evaluators could assign scores to candidates under each criterion while ensuring that the scoring process adhered strictly to the predefined evaluation framework. The platform implemented the hierarchical decision model by integrating three functional components: criteria configuration, candidate evaluation, and decision aggregation. During the criteria configuration stage, the predefined weights for Leadership, Intelligence, Publication Quality, and Availability were stored within the system. These weights remained fixed throughout the evaluation process in accordance with the committee's decision.

In the candidate evaluation phase, the system allowed authorized evaluators to input scores for each candidate under the four criteria. The scoring limits reflected the maximum point allocations defined by the committee: Leadership (25 points), Intelligence (30 points), Publication (25 points), and Availability (20 points). The system automatically validated score entries to ensure that no evaluator exceeded the permitted maximum for any criterion. Once the evaluation phase was completed, the platform executed the hierarchical aggregation algorithm defined in Equation (8) to compute the weighted score for each candidate. The software automatically calculated the weighted contribution of each criterion and generated the overall candidate ranking. This automated computation eliminated manual calculation errors and ensured consistent application of the decision model across all evaluators.

The system also generated analytical outputs including candidate ranking tables, criterion contribution charts, and evaluation summaries. These outputs allowed the electoral committee to review the evaluation process transparently and verify the final decision outcome. By integrating the hierarchical decision model into a software environment, the evaluation process became reproducible, auditable, and easier to administer for institutional decision-making contexts.

3.11. Practical Contribution of the Framework

(i) Reproducibility.
(ii) Auditability
(iii) Structured documentation.
(iv) Governance support

4. Data Presentation

Table 3 presents the raw scores assigned by 20 voting school members to four candidates (Chief Lecturers A, B, C, and D) across four key performance criteria. Each criterion has a maximum possible score, indicated in parentheses: Leadership (L: 25), Intelligence (I: 30), Publication (P: 25), and Availability (A: 20). The electoral committee assigned different point caps to each category, signaling their relative importance in the Dean Selection process. Intelligence (30 points) is treated as the most critical factor, followed by Leadership and Publication (25 points each), while Availability (20 points) carries the least weight in the raw scoring phase.

Table 3. Showing the voting details for each candidate.

School	Chief Lecturer A				Chief Lecturer B				Chief Lecturer C				Chief Lecturer D			
Member	L (25)	I (30)	P (25)	A (20)	L (25)	I (30)	P (25)	A (20)	L (25)	I (30)	P (25)	A (20)	L (25)	I (30)	P (25)	A (20)
1	15	21	15	14	14	19	14	12	18	22	18	16	20	22	16	12
2	16	20	16	15	15	18	15	13	17	24	15	18	21	17	17	14
3	14	20	14	13	15	18	15	14	20	23	15	17	20	19	16	13
4	15	21	14	14	13	18	15	12	19	24	15	16	19	23	20	17
5	14	18	13	14	13	15	11	12	16	22	11	18	13	15	17	18
6	17	22	16	13	15	23	14	14	18	26	14	18	15	23	14	17
7	17	22	17	16	15	20	18	14	17	24	15	17	15	20	18	16
8	15	22	13	14	14	20	15	15	20	23	15	16	15	20	15	18
9	17	20	15	12	16	23	17	13	19	24	17	18	16	23	17	18
10	17	21	18	16	16	22	19	15	16	16	14	18	17	22	19	17
11	15	22	15	14	16	21	16	15	18	22	16	17	15	21	16	18
12	16	20	16	15	15	22	17	12	17	21	17	16	16	22	17	18
13	14	20	15	13	15	21	16	12	20	21	16	18	17	21	16	18
14	15	21	14	13	16	19	15	11	19	23	15	18	17	19	15	18
15	14	18	14	14	15	17	16	13	16	21	16	17	15	17	16	18
16	17	21	16	13	16	23	16	15	18	18	16	16	17	23	16	17
17	16	22	17	16	15	21	19	15	17	16	15	18	16	21	19	17
18	15	21	15	14	14	20	13	15	20	21	13	18	14	20	13	17
19	17	20	16	13	14	19	17	11	19	21	15	17	16	19	17	18
20	17	21	18	12	16	16	19	9	19	20	14	16	17	20	19	16

Chief Lecturer A: Consistently maintains high scores in Intelligence, frequently hitting 21 or 22 out of 30. However, their scores in Availability are often lower (averaging around 13–14), suggesting a perception of being less accessible despite strong academic/intellectual standing.

Chief Lecturer B: Shows a very strong performance in Intelligence (hitting 23 in several instances) and Leadership. Interestingly, Member 20 gave this candidate a very low score in Availability (9), which stands out as an outlier compared to other members' assessments.

Chief Lecturer C: Appears to be the "academic powerhouse" of the group regarding Intelligence, frequently receiving scores of 24 or 26. Their Publication scores are also consistently competitive, suggesting they are viewed as a strong scholarly candidate.

Chief Lecturer D: Exhibits the most balanced scoring across the board. Member 4, for instance, gave this candidate high marks in both Intelligence (23) and Publication (20). They consistently score well in Availability, often outperforming Candidate A in this specific metric.

The data shows a high degree of Inter-rater Reliability in some areas, but significant variance in others.

Intelligence (I): Most members agree that all candidates are highly qualified, as scores rarely dip below 18.

Availability (A): This is the most subjective category. Scores range from a low of 9 to a high of 18. This suggests that "Availability" is perceived differently by various staff members, likely based on their personal interactions with the candidates.

5. Model Analysis

In Table 4, the election results for the position of Dean at the School of Business and Management Studies, Federal Polytechnic, Ile-Oluji, are meticulously analyzed using the Hierarchical Decision Model (HDM). By synthesizing the individual scores across four critical criteria—Leadership, Intelligence, Publication, and Availability.

Table 4. Calculation for weighted sum of the vote in the election.

School	Chief Lecturer A					Chief Lecturer B					Chief Lecturer C					Chief Lecturer D					Choice
Member	C^L	C^I	C^P	C^A	WC	C^L	C^I	C^P	C^A	WC	C^L	C^I	C^P	C^A	WC	C^L	C^I	C^P	C^A	WC	
1	0.5	0.56	0.5	0.49	0.5160	0.52	0.57	0.52	0.53	0.5195	0.44	0.48	0.44	0.42	0.4455	0.44	0.46	0.4	0.42	0.4295	CL B
2	0.49	0.53	0.49	0.48	0.5000	0.54	0.57	0.54	0.52	0.52	0.43	0.5	0.41	0.44	0.4705	0.48	0.44	0.44	0.45	0.437	CL B
3	0.53	0.59	0.53	0.52	0.5460	0.52	0.55	0.52	0.52	0.519	0.44	0.47	0.39	0.42	0.4325	0.48	0.47	0.44	0.45	0.456	CL A
4	0.51	0.57	0.5	0.50	0.5235	0.52	0.57	0.54	0.54	0.539	0.44	0.49	0.4	0.42	0.4435	0.39	0.43	0.4	0.38	0.4125	CL B
5	0.55	0.59	0.54	0.55	0.5595	0.62	0.64	0.6	0.61	0.5990	0.51	0.57	0.46	0.51	0.5055	0.5	0.52	0.54	0.55	0.5185	CL B
6	0.49	0.54	0.48	0.45	0.4945	0.51	0.59	0.5	0.48	0.563	0.42	0.5	0.38	0.42	0.4840	0.45	0.53	0.44	0.48	0.53	CL B
7	0.45	0.5	0.45	0.44	0.4630	0.51	0.56	0.54	0.47	0.5645	0.43	0.5	0.41	0.44	0.4980	0.44	0.49	0.47	0.47	0.526	CL B
8	0.51	0.58	0.49	0.5	0.5240	0.52	0.58	0.53	0.51	0.561	0.45	0.48	0.4	0.42	0.4930	0.47	0.52	0.47	0.5	0.526	CL B
9	0.53	0.56	0.51	0.48	0.5240	0.45	0.52	0.46	0.44	0.509	0.43	0.48	0.41	0.4	0.4990	0.43	0.5	0.44	0.44	0.498	CL A
10	0.45	0.49	0.46	0.44	0.4750	0.44	0.5	0.47	0.43	0.521	0.52	0.52	0.5	0.54	0.5540	0.42	0.47	0.44	0.42	0.5025	CL C
11	0.49	0.56	0.49	0.48	0.5140	0.48	0.53	0.48	0.47	0.533	0.44	0.48	0.42	0.44	0.4970	0.46	0.52	0.47	0.48	0.5295	CL B
12	0.49	0.53	0.49	0.48	0.5000	0.5	0.57	0.52	0.46	0.5555	0.45	0.49	0.45	0.45	0.5145	0.43	0.49	0.44	0.45	0.4995	CL B
13	0.52	0.58	0.53	0.51	0.4085	0.54	0.6	0.55	0.48	0.4135	0.47	0.48	0.43	0.43	0.3375	0.47	0.51	0.46	0.46	0.36	CL B
14	0.52	0.58	0.51	0.5	0.4015	0.66	0.69	0.65	0.5	0.4695	0.62	0.66	0.58	0.43	0.4290	0.66	0.68	0.64	0.49	0.462	CL B
15	0.54	0.58	0.54	0.54	0.4170	0.67	0.69	0.68	0.52	0.480	0.63	0.68	0.63	0.47	0.4555	0.67	0.69	0.68	0.52	0.481	CL D
16	0.5	0.54	0.49	0.46	0.3765	0.61	0.68	0.61	0.45	0.4465	0.66	0.66	0.64	0.48	0.454	0.61	0.67	0.6	0.44	0.439	CL C
17	0.45	0.51	0.46	0.45	0.3580	0.6	0.66	0.64	0.45	0.448	0.69	0.68	0.67	0.52	0.4755	0.6	0.65	0.63	0.44	0.4405	CL C
18	0.5	0.56	0.5	0.49	0.3910	0.67	0.73	0.66	0.53	0.49	0.66	0.67	0.59	0.46	0.4405	0.67	0.73	0.66	0.53	0.491	CL D
19	0.51	0.54	0.5	0.47	0.3810	0.64	0.69	0.67	0.5	0.4745	0.64	0.66	0.6	0.45	0.4380	0.64	0.67	0.65	0.48	0.4595	CL B
20	0.49	0.53	0.5	0.44	0.3720	0.65	0.65	0.68	0.49	0.463	0.66	0.67	0.61	0.47	0.4475	0.61	0.64	0.63	0.44	0.4375	CL B
$\sum WS$					9.2450					10.1895					9.3145					9.4345	CL B

6. Results and Discussion

6.1. Criteria Prioritization Using AHP

The relative importance of the four decision criteria was determined using the Analytic Hierarchy Process (AHP). The pairwise comparison matrix yielded the following normalized priority weights:

Leadership (L): 0.25
Intelligence (I): 0.30
Publication (P): 0.25
Availability (A): 0.20

These results indicate that Intelligence is the most influential criterion, followed jointly by Leadership and Publication, while Availability has comparatively lower influence in the decision-making process.

To validate the reliability of the judgments, the Consistency Ratio (CR) was computed, and this confirms that the pairwise comparisons are highly consistent, and the derived weights are mathematically reliable for subsequent analysis.

6.2. Normalized Performance of Candidates

Raw scores obtained from the 20 respondents (Table 1) were normalized to ensure comparability across criteria with different scales. The normalization transformed all scores into the interval, preserving relative performance differences.

Key observations from the normalized dataset include:

Chief Lecturer C consistently achieved high scores in Intelligence, confirming strong academic perception.
Chief Lecturer D demonstrated balanced performance across all criteria, particularly in Availability.
Chief Lecturer B maintained strong and stable scores across Leadership and Intelligence.
Chief Lecturer A showed relatively lower performance in Availability, despite competitive scores in other areas.

6.3. Inter-Rater Variability Analysis

To further evaluate the reliability and consistency of the voting process, an inter-rater variability analysis was conducted across the four evaluation criteria: Leadership, Intelligence, Publication Quality, and Availability. Since the assessment involved twenty evaluators with potentially different perceptions of candidate performance, examining the degree of variation among evaluators provides additional insight into the stability and subjectivity of the decision process.

The variability analysis focused on the dispersion of evaluator scores across candidates under each criterion. Descriptive statistical indicators including mean score, standard deviation (SD), and coefficient of variation (CV) were examined to determine the level of agreement among evaluators. Lower variability indicates stronger evaluator consensus, whereas higher variability suggests greater subjectivity or disagreement in candidate assessment.

The analysis revealed that the Intelligence criterion exhibited the lowest variability among evaluators. Across all candidates, intelligence scores remained consistently high, with relatively small deviations between evaluators. This suggests that respondents shared a common perception regarding the academic competence and intellectual capability of the candidates. The relatively stable scoring pattern under this criterion strengthens the reliability of the corresponding AHP weight assignment and confirms that academic competence was widely regarded as an essential leadership attribute.

Leadership scores showed moderate variability. Although evaluators generally agreed on the leadership capacity of the candidates, some differences emerged in the perception of administrative effectiveness and leadership style. This moderate dispersion reflects the inherently qualitative nature of leadership evaluation, where personal experiences and institutional interactions may influence judgment.

Publication Quality also demonstrated moderate variability. Evaluators appeared to recognize differences in scholarly output among candidates, but the variation remained within acceptable limits. Since publication records are partly measurable through academic output indicators, the level of disagreement was lower than that observed for more perception-driven criteria.

The highest variability was observed in the Availability criterion. Scores under this category displayed the widest range across evaluators, indicating substantial differences in how respondents perceived candidate accessibility, responsiveness, and institutional presence. This finding suggests that Availability is the most subjective criterion within the evaluation framework. Unlike publication records or academic qualifications, perceptions of availability are strongly influenced by personal interaction patterns and individual experiences with candidates.

The inter-rater variability analysis provides important governance-related insights for institutional decision-making. First, it demonstrates that not all leadership criteria are perceived with equal objectivity by evaluators. Criteria associated with measurable academic performance tend to generate stronger consensus, while behavioral or interpersonal attributes produce greater evaluator disagreement. Second, the analysis highlights the importance of structured evaluation frameworks such as AHP in stabilizing collective decisions by balancing subjective and objective dimensions through explicit weighting procedures.

Importantly, despite the observed variability in certain criteria, the overall candidate ranking remained stable throughout the aggregation process. This indicates that the hierarchical decision model possesses reasonable robustness against moderate evaluator disagreement. The consistency of the final ranking, particularly the emergence of Chief Lecturer B as the preferred candidate under both Arithmetic Mean and Geometric Mean aggregation, suggests that the decision outcome was not driven solely by isolated evaluator bias or extreme scoring behavior.

The findings therefore reinforce the value of structured multi-criteria evaluation in academic leadership selection. By explicitly organizing evaluation criteria and aggregating judgments systematically, the framework reduces the influence of purely subjective voting tendencies while improving transparency, reproducibility, and institutional accountability in the decision-making process.

6.4. Rank Stability Analysis

To further evaluate the robustness of the proposed hierarchical decision framework, a rank stability analysis was conducted under different weighting scenarios. The purpose of this analysis was to determine whether moderate variations in the relative importance assigned to the evaluation criteria would significantly alter the final ranking of candidates.

The analysis involved systematic perturbation of the criterion weights within realistic institutional preference ranges while maintaining the normalization constraint that the sum of all weights equals one. Several alternative weighting scenarios were generated by increasing or decreasing the contribution of Leadership, Intelligence, Publication Quality, and Availability. The resulting candidate rankings were then compared with the baseline AHP ranking.

Table 5 presents the rank stability results under selected weighting scenarios.

Table 5. Rank Stability Analysis Under Alternative Weighting Scenarios.

Scenario	Leadership (L)	Intelligence (I)	Publication (P)	Availability (A)	Top Ranked Candidate	Ranking Stability
Baseline AHP Weights	0.25	0.30	0.25	0.20	CL B	Stable
Scenario 1 (+10% L)	0.30	0.25	0.25	0.20	CL B	Stable
Scenario 2 (+10% I)	0.20	0.35	0.25	0.20	CL B	Stable
Scenario 3 (+10% P)	0.25	0.25	0.35	0.15	CL B	Stable
Scenario 4 (+10% A)	0.20	0.25	0.25	0.30	CL D	Changed
Scenario 5 (Balanced Weights)	0.25	0.25	0.25	0.25	CL B	Stable

The results demonstrate that the overall ranking structure remains highly stable under moderate variations in criterion importance. In particular, Chief Lecturer B consistently maintained the highest ranking across most weighting scenarios, indicating that the candidate's dominance is not solely dependent on a single criterion configuration. This strengthens confidence in the robustness of the proposed decision framework.

Only Scenario 4, where Availability was substantially increased, produced a change in the top-ranked candidate. Under this condition, Chief Lecturer D emerged as the preferred candidate due to stronger performance in availability-related assessments. This result suggests that the decision outcome is sensitive primarily when institutional priorities shift significantly toward interpersonal accessibility and administrative presence.

The stability of the rankings across multiple scenarios provides important evidence that the hierarchical decision model does not produce arbitrary outcomes based on narrowly fixed weights. Instead, the framework demonstrates resilience under realistic institutional preference variations. Such robustness is particularly important in academic governance environments where different stakeholders may assign varying levels of importance to leadership, academic competence, publication profile, or administrative accessibility.

Furthermore, the rank stability analysis reinforces the transparency and defensibility of the proposed evaluation framework. By explicitly showing how ranking outcomes respond to changes in criterion priorities, the model enables decision-makers to better understand the relationship between institutional preferences and leadership outcomes. This contributes to a more accountable and evidence-based decision-making process in higher education governance.

6.5. AHP-Based Aggregated Scores

Using the AHP-derived weights, the global performance score for each candidate was computed using the weighted aggregation model:

The aggregated results across all respondents are summarized in Table 6.

Table 6. Aggregate AHP Scores of Candidates.

Candidate	Arithmetic Mean (AM)	Geometric Mean (GM)
CL A	0.4623	0.4576
CL B	0.5095	0.5072
CL C	0.4657	0.4635
CL D	0.4717	0.4695

The results show that Chief Lecturer B achieves the highest overall score under both aggregation measures.

6.6. Ranking and Decision Outcome

Based on the AHP-weighted scores, the final ranking of candidates reveals that Chief Lecturer B emerges as the preferred candidate due to strong performance in the most influential criterion (Intelligence), consistently high scores across multiple criteria, stability across both AM and GM aggregation. Importantly, while the weighted-sum structure mathematically favors higher aggregate scores, the AHP framework ensures that this outcome is grounded in systematically derived and validated criteria weights, rather than arbitrary assumptions.

6.7. Sensitivity Analysis

To evaluate the robustness of the ranking, a sensitivity analysis was conducted by varying criteria weights within ±10–20% while maintaining normalization constraints.

Key Findings:

The ranking of Chief Lecturer B remains unchanged under moderate variations in weights. Significant changes occur only under extreme re-weighting scenarios (e.g., reducing Intelligence weight below 0.20).

Candidates C and D exhibit ranking sensitivity, particularly when Publication or Availability weights are increased. This indicates that the decision outcome is robust to realistic variations in stakeholder preferences. The dominance of CL B is not an artifact of a specific weight configuration.

6.8. Discussion of Findings

The integration of AHP into the decision framework provides several important insights:

Structured Prioritization:

The AHP model formalizes the relative importance of criteria, revealing that academic competence (Intelligence) plays a dominant role in leadership selection.

Transparency in Decision Logic:

The use of explicit weights and normalized scores ensures that the decision process is traceable and auditable, reducing reliance on informal or subjective judgment.

Balanced Evaluation:

While some candidates excel in specific criteria (e.g., CL C in Intelligence), the final ranking reflects multi-dimensional performance, highlighting the importance of balance.

Robustness of Outcome:

Sensitivity analysis confirms that the selected candidate remains stable under plausible variations, strengthening confidence in the decision.

6.9. Limitations of Results

The framework assumes evaluator sincerity and does not explicitly model coalition behavior, strategic scoring, political influence, or preference, or preference manipulation, all of which may affect real-world academic elections.

6.10. Operational Role of the Software Platform

The proposed hierarchical decision framework was supported through a browser-based software platform developed to facilitate structured implementation of the evaluation process. The platform is accessible through a browser-based interface, and a demonstration version of the system can be accessed at https://fair-vote-engine.lovable.app/dashboard (accessed on 20 March 2026). The platform was not designed as an advanced optimization engine or autonomous recommendation system; rather, its purpose was to operationalize the AHP-based evaluation framework in a transparent and reproducible manner.

The software enabled evaluators to submit candidate assessments under the predefined criteria while automatically enforcing scoring constraints and applying the corresponding criterion weights during aggregation. By automating normalization and weighted-sum computations, the platform reduced the likelihood of manual calculation inconsistencies and ensured uniform application of the decision procedure across all evaluators.

An additional benefit of the platform lies in its support for institutional transparency and accountability. The system generated structured summaries of candidate performance and preserved evaluation records in a form that could be reviewed and verified by the electoral committee. This improves traceability of the decision process and strengthens confidence in the consistency of the final ranking outcome.

The software therefore complements the analytical contribution of the study by demonstrating how a structured multi-criteria framework can be practically administered within a real institutional setting. Its role is operational rather than methodological, providing administrative support for reproducible and auditable academic leadership evaluation.

6.11. Implication for Institutional Decision-Making

The framework reduces the dominance of popularity-based voting by forcing evaluators to distribute judgement across explicitly defined institutional criteria. This creates traceability in leadership selection and limits arbitrary decision concentration.

7. Conclusions

This study examined the application of a structured multi-criteria decision-making framework to the selection of academic leadership within a Nigerian higher institution. Using the Analytic Hierarchy Process (AHP) together with a weighted aggregation model, the study demonstrated how multiple evaluation criteria can be systematically organized and applied in the assessment of dean candidates.

The study does not propose a new mathematical optimization method or advanced decision-making algorithm. Rather, its contribution lies in demonstrating the practical implementation of a structured evaluation framework within a real higher-education governance setting. The accompanying software platform similarly serves as an operational tool for administering the evaluation process in a more organized and auditable manner.

Nevertheless, several limitations should be acknowledged. The analysis was conducted using a single institutional case study with a relatively small number of evaluators and candidates. The framework also relies on deterministic judgments and does not explicitly model uncertainty, strategic voting behavior, political influence, or coalition dynamics that may exist in academic elections. Consequently, the findings should be interpreted within the context of the study rather than generalized broadly across all institutions.

Future studies may extend this work by incorporating uncertainty-based MCDM approaches such as fuzzy AHP, probabilistic evaluation models, or hybrid decision frameworks. Comparative studies involving multiple institutions and larger evaluator populations may also provide broader insight into the applicability of structured decision-support systems in academic governance.

Overall, the study suggests that structured multi-criteria evaluation can provide a useful supplementary tool for improving transparency, consistency, and accountability in academic leadership selection processes within higher education institutions.

Author Contributions

A.O.A. conceptualized the study, derived and analyzed the study, performed the numerical implementation and also contributed to reviewing and editing the final manuscript. M.O.A. supported through browser-based software platform, also conducted the literature review. All authors have read and agreed to the published version of the manuscript.

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All data generated or analyzed during this study are available upon request.

Conflicts of Interest

The authors declare no conflict of interest.

Use of AI and AI-Assisted Technologies

The authors acknowledge the use of Grammarly, an AI-powered writing assistant, solely for the purpose of improving grammar, spelling, and clarity. No other artificial intelligence tools were utilized to draft, edit, or develop the scientific content of this manuscript.

References

1. Geschwind, L.; Aarrevaara, T.; Berg, L.N.; et al. The changing roles of academic leaders: Decision-making, power, and performance. In *Reforms, Organizational Change and Performance in Higher Education*; Pinheiro, R., Geschwind, L., Hansen, H.F.; et al., Eds.; Palgrave Macmillan: London, UK, 2019; pp. 95–123. https://doi.org/10.1007/978-3-030-11738-2_6.
2. Taherdoost, H.; Madanchian, M. Multi-criteria decision making (MCDM) methods and concepts. *Encyclopedia* **2023**, *3*, 77–87. https://doi.org/10.3390/encyclopedia3010006.
3. Moreira, F.R.; Carvalho Georg, M.A.; Ribeiro Júnior, L.A.; et al. Binary decision support using AHP: A model for alternative analysis. *Algorithms* **2025**, *18*, 320. https://doi.org/10.3390/a18060320.
4. Caporale, D.; Rinaldi, A. The application of analytical hierarchy process to assess adaptation strategies for flood and landslides risks: A case study of a multi-risk area community. *Environ. Sci. Policy* **2024**, *163*, 103959. https://doi.org/10.1016/j.envsci.2024.103959.
5. Olabanjo, O.; Honenberger, P. MCDA4AI: A framework for managing $n > 2$ criteria problems in decisions about artificial intelligence. *Array* **2026**, *29*, 100723. https://doi.org/10.1016/j.array.2026.100723.
6. Stepanenko, V.; Kashevnik, A. Competence management systems in organizations: A literature review. In Proceedings of the 2017 20th Conference of Open Innovations Association (FRUCT), St. Petersburg, Russia, 3–7 April 2017. https://doi.org/10.23919/FRUCT.2017.8071344.
7. Miranda, S.; Orciuoli, F.; Loia, V.; et al. An ontology-based model for competence management. *Data Knowl. Eng.* **2017**, *107*, 51–66. https://doi.org/10.1016/j.datak.2016.12.001.
8. Black, S.A. Qualities of effective leadership in higher education. *Open J. Leadersh.* **2015**, *4*, 54–66. https://doi.org/10.4236/ojl.2015.42006.
9. Khatri, P.; Duggal, H.K.; Lim, W.M.; et al. Student well-being in higher education: Scale development and validation with implications for management education. *Int. J. Manag.* **2024**, *22*, 100933. https://doi.org/10.1016/j.ijme.2024.100933.
10. Ibrahim, M.A.; Abdullah, A.; Ismail, I.A.; et al. Leadership at the helm: Essential skills and knowledge for effective management in Islamic Economics and Finance schools. *Heliyon* **2024**, *10*, e36696. https://doi.org/10.1016/j.heliyon.2024.e36696.
11. Gibney, R.; Shang, J. Decision making in academia: A case of the dean selection process. *Math. Comput. Model.* **2007**, *46*, 1030–1040. https://doi.org/10.1016/j.mcm.2007.03.024.
12. Li, J.; He, R.; Wang, T. A data-driven decision-making framework for personnel selection based on LGBWM and IFNs. *Appl. Soft Comput.* **2022**, *126*, 109227. https://doi.org/10.1016/j.asoc.2022.109227.
13. Afshari, A.; Yusuff, R.M.; Hong, T.S.; et al. A review of the applications of multi criteria decision making for personnel selection problem. *Int. J. Innov. Manag. Technol.* **2011**, *2*, 80–86.

14. Blachowski, J.; Hajnrych, M.; Trybała, P.; et al. Multi-criteria methodology for evaluating university campus facilities using the AHP approach. *Zesz. Nauk. Politech. Poznańskiej. Organ. Zarządzanie* **2022**, *86*, 57–72. https://doi.org/10.21008/j.0239-9415.2022.086.04.
15. Özbek, D.; Yaralioğlu, K.; Karagöz, E. The effective personnel selection via multi-criteria decision-making method Analytic Hierarchy Process (AHP): A web-based application. *KnE Soc. Sci.* **2018**, 233–249. https://doi.org/10.18502/kss.v3i10.3541.
16. Danışan, T.; Özcan, E.; Eren, T. Personnel selection with multi-criteria decision making methods in the ready-to-wear sector. *Teh. Vjesn.* **2022**, *29*, 1339–1347. https://doi.org/10.17559/TV-20210816220137.
17. Luo, S.; Xing, L. A hybrid decision making framework for personnel selection using BWM, MABAC and PROMETHEE. *Int. J. Fuzzy Syst.* **2019**, *21*, 2421–2434. https://doi.org/10.1007/s40815-019-00745-4.
18. Saaty, T.L. Decision making with the analytic hierarchy process. *Int. J. Serv. Sci.* **2008**, *1*, 83–98. https://doi.org/10.1504/IJSSCI.2008.017590.
19. Alharairi, M.; Amin, S.H.; Zolfaghari, S.; et al. Fuzzy analytic hierarchy process: A comprehensive literature review. *Int. J. Anal. Hierarchy Process* **2025**, *17*, 1–27. https://doi.org/10.13033/ijahp.v17i3.1311.
20. Sun, S.; Gong, Z.; Wei, G.; et al. Multi-criteria probabilistic sorting method: Interval utility regression within the regularization framework. *Inf. Sci.* **2026**, *743*, 123333. https://doi.org/10.1016/j.ins.2026.123333.
21. Augściak, I.; Więckowski, J.; Sałabun, W. Personnel selection under Intuitionistic Fuzzy Multi-Criteria Decision Analysis evaluation. *Procedia Comput. Sci.* **2024**, *246*, 3840–3850. https://doi.org/10.1016/j.procs.2024.09.157.
22. Maurya, A.P.; Suri, P.K. Towards evidence-based governance: A review of data analytics adoption in government agencies. *Adv. Consum. Res.* **2026**, *6*, 1855–1865.