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Improved MAUT Framework for Quality Evaluation of University Party Building Work in the New Era Based on the Interval Neutrosophic Multi-Attribute Group Decision-Making

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Abstract: In the new era, the evaluation of the quality of party-building work in universities focuses on strengthening political, ideological, and organizational construction. By using a scientific evaluation system, it ensures the implementation of Party theories and policies. It emphasizes innovative methods to enhance Party members' ideological awareness and organizational skills, promoting the integration of Party building with education. This ensures the Party's leadership plays a central role in all university activities, driving comprehensive development. The quality evaluation of university party building work in the new era is a multi-attribute group decision-making (MAGDM) problem. Recently, both the MAUT method and the average approach have been applied to solve MAGDM challenges. Interval Neutrosophic Sets (INSs) are utilized to represent uncertain data during the quality evaluation of university party-building work in the new era. In this study, the MAUT method is adapted for MAGDM with INSs. Furthermore, the Interval Neutrosophic Number MAUT (INN- MAUT) approach is developed for MAGDM. The average approach is used to determine the criteria weights within the INS framework. Finally, a numerical example is provided to demonstrate the application of the INN- MAUT approach in the quality evaluation of university party-building work in the new era. The key contributions of this study include: (1) the development of a MAGDM method using the INN- MAUT approach with INSs, (2) the application of the average method to compute weights under INSs, and (3) the proposal of a novel MAGDM approach for quality evaluation of university party building work in the new era using the INN- MAUT method.

Keywords: Multiple-attribute group decision-making (MAGDM); INSs; MAUT approach; quality evaluation of university party building work; Neutrosophic sets

1. Introduction

In the study of party-building in Chinese higher education institutions, scholars proposed various theoretical and practical innovations tailored to the needs of different times. Below is a chronological review of the literature. In 2004, Zhou [1] explored the current state of democratic life meetings within student party branches and proposed strategies to improve their quality, aiming to enhance the effectiveness of student party-building efforts. In 2008, Su [2] introduced the ISO9001 quality management system to university party-building, emphasizing process management to improve the scientific and standardized operation of party-building work. In 2012, Xu [3] analyzed the characteristics and challenges of student party-building in private universities and provided targeted solutions, highlighting the uniqueness of party-building in private institutions. In 2013, Li [4] further examined the application of the ISO9000 quality management system in party-building, offering a systematic approach to enhance university party work. In 2015, Liu [5] discussed the impact of changing domestic and international political environments on student party-building and proposed pathways to optimize the quality of party-building, emphasizing the deepened education of student party members. In 2016, Gao [6] argued that the core of university party-building was “fostering virtue through education,” stressing the importance of ideological guidance throughout talent cultivation processes. In 2018, Ma [7] reviewed the evolution of quality evaluation mechanisms in university party-building since the reform and opening-up period, emphasizing problem-oriented approaches in the new era to improve the quality of party-building efforts. In 2019, Lu [8] analyzed challenges in building online party platforms in universities and suggested developing more systematic, appealing, and efficient e-governance platforms for party-building. In 2020, Chen [9] emphasized the role of party-building in cultivating innovative talents, advocating for innovative approaches to foster students’ creativity and enhance educational quality. In 2021, Qi [10] explored the construction of a quality evaluation system for grassroots party-building in university departments, systematically addressing organizational functions, institutional guarantees, and other critical factors. In 2022, Mi [11] highlighted the practical applications of digital technology in enhancing party-building, analyzing its contributions to improving organizational quality, and identifying challenges such as technological bottlenecks and ethical issues. In 2023, Gao [12] studied the role of party-building in senior cadre work at universities, proposing strategies to leverage the political and experiential advantages of retired party members. In the same year, Wang, Cheng, and Chen [13] discussed the integration of party-building with operational work in private universities, constructing a quality evaluation system tailored to new era demands. In 2024, Zhao and Zhang [14] focused on building a high-quality university party-building system by integrating political and organizational functions while innovating party activities to achieve the “integration and dual excellence” goals. Liu, Xu and Dong [15] summarized the current status and challenges of grassroots party-building in universities and proposed the "Five Strengthenings" strategy to promote high-quality development of grassroots party-building.

MAGDM is a method used to address complex decision-making problems involving multiple decision-makers and multiple evaluation attributes. Its core objective is to find the optimal decision solution by comprehensively considering the preferences of different decision-makers and the impact of various attributes. Typically, the MAGDM process includes defining decision goals, selecting and defining evaluation attributes, collecting and standardizing data, assigning weights, and conducting comprehensive evaluation and ranking. Decision-makers can use various methods, such as the Analytic Hierarchy Process (AHP), fuzzy comprehensive evaluation, or the CoCoSo technique[16], to evaluate and compare alternatives. MAGDM is widely applied in fields such as engineering, economics, management, and social sciences, aiding organizations in making more scientific and rational choices in diverse and complex decision environments. By integrating multiple opinions and criteria, MAGDM effectively enhances the objectivity and fairness of decision-making. The quality evaluation of university party-building work in the new era falls within the framework of MAGDM.

Currently, both the MAUT methods [17] are employed to address various challenges in MAGDM. However, there has been limited application of these methods in combination with INSs [18], which are highly effective in representing uncertain and imprecise data, such as that encountered in evaluating virtual reality user experiences. Specifically, the integration of average with the MAUT technique within the context of INSs has not been extensively studied.

To address this gap, we propose the INN-MAUT approach, a novel method that integrates average solve MAGDM problems under INSs. This approach is designed to handle the complexity and uncertainty inherent in modern decision-making environments, such as quality evaluation of university party-building work in the new era.

By incorporating INSs, the INN-MAUT method provides a more flexible and comprehensive framework for representing the uncertain preferences of decision-makers. An illustrative example focusing on the evaluation of virtual reality user experiences is presented to demonstrate the effectiveness and reliability of the INN-MAUT approach.

A comparative analysis is also included to showcase the advantages of this technique over existing methods. In addition to this example, a numerical study on quality evaluation of university party building work in the new era is conducted to validate the practical application of the proposed approach.

This study highlights the robustness of the INN-MAUT technique in addressing real-world MAGDM problems. In this paper, the INN-MAUT approach is constructed to address MAGDM problems using INSs. Furthermore, an average-based approach is developed to determine the weight values of different attributes, within the INSs framework. This ensures that the decision-making process is both objective and efficient, with the average approach providing a systematic method to assign appropriate weights to each criterion.

The main objectives of this study are as follows: (1) To develop a MAGDM approach using the INN- MAUT method under INSs; (2) To construct an average-based approach for deriving weight values within INSs; and (3) To propose a novel MAGDM solution for quality evaluation of university party building work in the new era utilizing the INN- MAUT technique. By addressing these objectives, this study contributes to the advancement of decision-making methodologies in complex, uncertain environments like quality evaluation of university party-building work in the new era. Figure 1 shows the types of uncertainty models.

The structure of this study is organized as follows: Section 2 introduces the INSs, providing the

background necessary for understanding the subsequent methods. Section 3 describes the development of the INN- MAUT approach using INSs integrated with average, detailing the methodological framework. Section 4 presents a numerical example focused on quality evaluation of university party building work in the new era, accompanied by a comparative analysis to demonstrate the approach's effectiveness. Finally, Section 5 offers concluding remarks, summarizing the key findings and implications of the study.

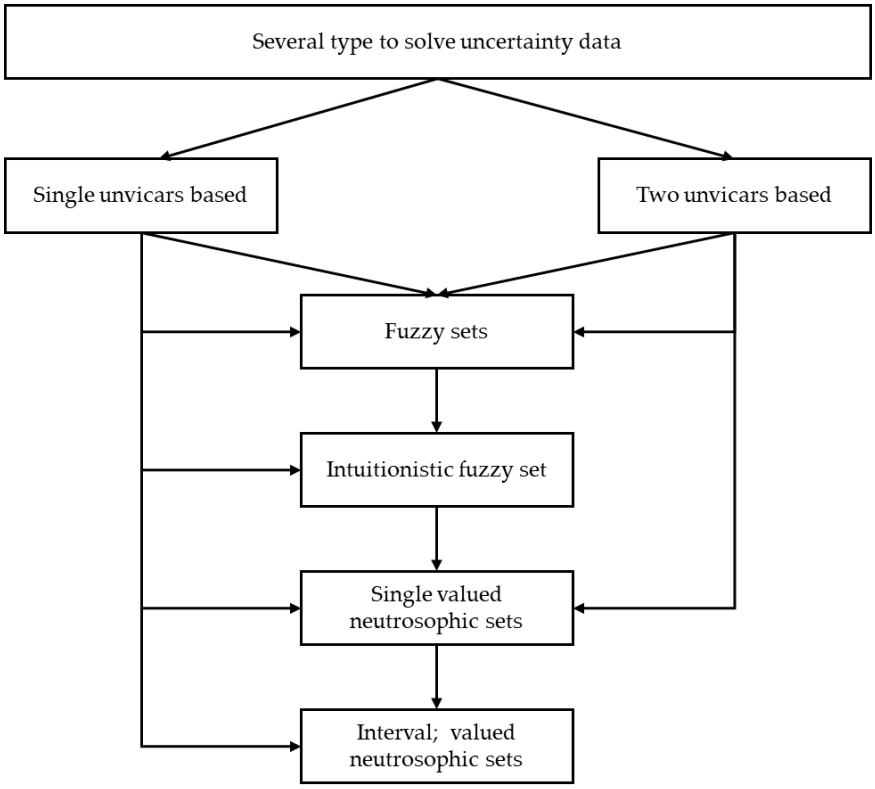

Figure 1. Types of uncertainty models.

2. Preliminaries

The neutrosophic set is defined with three elements such as truth, indeterminacy, and falsity functions [18].

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$0-\leq \sup T_A + \sup I_A + \sup F_A \leq 3+$

The IVNNs operations can be defined as:

$$\vartheta A = \left(\begin{bmatrix} 1-\left(1-T_A^L(x)\right)^{\vartheta}, \\ 1-\left(1-T_A^U(x)\right)^{\vartheta} \end{bmatrix}, \begin{bmatrix} \left(I_A^L(x)\right)^{\vartheta}, \left(I_A^U(x)\right)^{\vartheta} \end{bmatrix}, \begin{bmatrix} \left(F_A^L(x)\right)^{\vartheta}, \left(F_A^U(x)\right)^{\vartheta} \end{bmatrix} \right) \tag{1}$$

$$A+B = \left(\begin{bmatrix} T_A^L(x)+T_B^L(x)-T_A^L(x)T_B^L(x), \\ T_A^U(x)+T_B^U(x)-T_A^U(x)T_B^U(x) \end{bmatrix}, \begin{matrix} [I_A^L(x)I_B^L(x), I_A^U(x)I_B^U(x)], \\ [F_A^L(x)F_B^L(x), F_A^U(x)F_B^U(x)] \end{matrix} \right) \tag{2}$$

$$A-B = \left(\begin{matrix} [T_A^L(x)-T_A^U(x), T_A^U(x)-T_A^U(x)], \\ \begin{bmatrix} \max\left(I_A^L(x), I_B^L(x)\right), \\ \max\left(I_A^U(x), I_B^U(x)\right) \end{bmatrix}, \\ \begin{bmatrix} F_A^L(x)-F_A^U(x) \\ , F_A^U(x)-F_A^U(x) \end{bmatrix} \end{matrix} \right) \tag{3}$$

$$AB = \left(\begin{matrix} [T_A^L(x)T_B^L(x), T_A^U(x)T_B^U(x)], \\ \begin{bmatrix} I_A^L(x)+I_B^L(x)-I_A^L(x)I_B^L(x) \\ , I_A^U(x)+I_B^U(x)-I_A^U(x)I_B^U(x) \end{bmatrix}, \\ \begin{bmatrix} F_A^L(x)+F_B^L(x)-F_A^L(x)F_B^L(x), \\ F_A^U(x)+F_B^U(x)-F_A^U(x)F_B^U(x) \end{bmatrix} \end{matrix} \right) \tag{4}$$

$$\frac{A}{B} = \left(\begin{bmatrix} \min\left\{ \frac{T_A^L(x)}{T_B^L(x)}, \frac{T_A^L(x)}{T_B^U(x)}, \frac{T_A^U(x)}{T_B^L(x)}, \frac{T_A^U(x)}{T_B^U(x)} \right\}, \\ \max\left\{ \frac{T_A^L(x)}{T_B^L(x)}, \frac{T_A^L(x)}{T_B^U(x)}, \frac{T_A^U(x)}{T_B^L(x)}, \frac{T_A^U(x)}{T_B^U(x)} \right\} \end{bmatrix}, \begin{bmatrix} \min\left\{ \frac{I_A^L(x)}{I_B^L(x)}, \frac{I_A^L(x)}{I_B^U(x)}, \frac{I_A^U(x)}{I_B^L(x)}, \frac{I_A^U(x)}{I_B^U(x)} \right\}, \\ \max\left\{ \frac{I_A^L(x)}{I_B^L(x)}, \frac{I_A^L(x)}{I_B^U(x)}, \frac{I_A^U(x)}{I_B^L(x)}, \frac{I_A^U(x)}{I_B^U(x)} \right\} \end{bmatrix}, \begin{bmatrix} \min\left\{ \frac{F_A^L(x)}{F_B^L(x)}, \frac{F_A^L(x)}{F_B^U(x)}, \frac{F_A^U(x)}{F_B^L(x)}, \frac{F_A^U(x)}{F_B^U(x)} \right\}, \\ \max\left\{ \frac{F_A^L(x)}{F_B^L(x)}, \frac{F_A^L(x)}{F_B^U(x)}, \frac{F_A^U(x)}{F_B^L(x)}, \frac{F_A^U(x)}{F_B^U(x)} \right\} \end{bmatrix} \right) \tag{5}$$

3. The Proposed Study

This section shows the steps of the INN-MAUT for ranking the alternatives.

Step 1. Create the decision matrix.

Three experts used the neutrosophic numbers to evaluate the criteria and alternatives. Then we apply the score function to obtain one value. Then we combine these opinions into one matrix.

Step 2. Normalize the decision matrix

The decision matrix values are normalized based on the positive and negative kinds of criteria. The blow equation is used to normalize the decision matrix for the positive and negative criteria.

$$x_{ij} = \frac{y_{ij} - \min(y_{ij})}{\max(y_{ij}) - \min(y_{ij})}; i = 1, \dots, m; j = 1, \dots, n \quad (6)$$

$$x_{ij} = 1 + \frac{\min(y_{ij}) - y_{ij}}{\max(y_{ij}) - \min(y_{ij})}; i = 1, \dots, m; j = 1, \dots, n \quad (7)$$

Step 3. Determine the marginal utility score.

The below equation is used to compute the marginal utility score.

$$r_{ij} = \frac{e^{(x_{ij})^2} - 1}{1.71} \quad (8)$$

Step 4. Determine the final utility score

The final utility score of each alternative is computed using the below equation with the criteria weights.

$$P_i = \sum_{j=1}^{n} r_{ij} w_j \quad (9)$$

Step 5. Final rank of alternatives.

The final utility score of each alternative is ranked in descending order for the final rank of alternatives. The alternative is the highest rank is the best and the alternative is the lowest rank is the worst.

4. Actual DM Example

The quality evaluation of university party building work in the new era is MAGDM. Six potential local universities are evaluated with 9 attributes.

1. Ideological and Political Leadership

Assesses the effectiveness of Party organizations in guiding the ideological and political direction of the university. This includes fostering the correct political values among faculty and students, promoting patriotism, and ensuring adherence to Party principles in education and research.

2. Organizational Development

Evaluates the establishment and functioning of Party organizations within the university, including their structures, roles, and representation. It ensures that Party committees are active at various levels (department, student groups) and align with broader organizational goals.

3. Integration of Party Building with Core Educational Tasks

Measures how well Party building is integrated with teaching, research, and administrative tasks. This involves aligning Party-building activities with the university's strategic goals, such as talent cultivation, innovation, and community service.

4. Effectiveness of Ideological Education

Analyzes the quality of ideological and moral education imparted to students and staff. This includes curriculum design, extracurricular activities promoting Party values, and the impact of ideological courses on students' beliefs and actions.

5. Leadership in Social Responsibility and Service

Assesses the university's Party organization's role in contributing to societal development and serving the community. This includes outreach programs, social impact projects, and initiatives that showcase the Party's commitment to the public good.

6. Student Engagement in Party Activities

Examine the participation rate and quality of student involvement in Party-building activities. This includes membership drives, leadership training programs, and the formation of youth leagues to cultivate future Party leaders.

7. Party Member Development and Training

Evaluates the processes for identifying, recruiting, and training Party members among students and

staff. It focuses on the quality of training programs, mentorship opportunities, and the retention of highly committed members.

8. Ethical Governance and Anti-Corruption Measures

Monitors the transparency, accountability, and ethical practices within Party organizations in the university. This includes compliance with anti-corruption measures and fostering a culture of integrity and fairness in all Party-related activities.

9. Cultural Promotion and Party Branding

Assesses efforts to promote Party culture within the campus through events, publications, and media. This includes branding the university as a model for Party-led education and integrating cultural activities with Party themes.

Step 1. We created the decision matrix between criteria and alternatives by three experts.

For the first expert:

$$y_{ij} = \left\{ \begin{pmatrix} ([0.5,0.5],[0.6,0.7],[0.4,0.5]), ([0.3,0.4],[0.4,0.5],[0.6,0.7]), ([0.2,0.3],[0.3,0.4],[0.7,0.8]), \\ ([0.1,0.2],[0.1,0.2],[0.8,0.9]), ([0.8,0.9],[0.1,0.2],[0.1,0.2]), ([0.7,0.8],[0.2,0.3],[0.2,0.3]), \\ ([0.6,0.7],[0.4,0.5],[0.3,0.4]), ([0.5,0.6],[0.5,0.6],[0.4,0.5]), ([0.5,0.5],[0.6,0.7],[0.4,0.5]) \end{pmatrix}, \right.$$
$$\begin{pmatrix} ([0.4,0.5],[0.5,0.6],[0.5,0.6]), ([0.5,0.5],[0.6,0.7],[0.4,0.5]), ([0.5,0.5],[0.6,0.7],[0.4,0.5]), \\ ([0.4,0.5],[0.5,0.6],[0.5,0.6]), ([0.3,0.4],[0.4,0.5],[0.6,0.7]), ([0.5,0.5],[0.6,0.7],[0.4,0.5]), \\ ([0.1,0.2],[0.1,0.2],[0.8,0.9]), ([0.5,0.5],[0.6,0.7],[0.4,0.5]), ([0.4,0.5],[0.5,0.6],[0.5,0.6]) \end{pmatrix},$$
$$\begin{pmatrix} ([0.3,0.4],[0.4,0.5],[0.6,0.7]), ([0.4,0.5],[0.5,0.6],[0.5,0.6]), ([0.5,0.5],[0.6,0.7],[0.4,0.5]), \\ ([0.7,0.8],[0.2,0.3],[0.2,0.3]), ([0.5,0.5],[0.6,0.7],[0.4,0.5]), ([0.4,0.5],[0.5,0.6],[0.5,0.6]), \\ ([0.5,0.5],[0.6,0.7],[0.4,0.5]), ([0.4,0.5],[0.5,0.6],[0.5,0.6]), ([0.5,0.5],[0.6,0.7],[0.4,0.5]) \end{pmatrix},$$
$$\begin{pmatrix} ([0.6,0.7],[0.4,0.5],[0.3,0.4]), ([0.3,0.4],[0.4,0.5],[0.6,0.7]), ([0.4,0.5],[0.5,0.6],[0.5,0.6]), \\ ([0.5,0.5],[0.6,0.7],[0.4,0.5]), ([0.4,0.5],[0.5,0.6],[0.5,0.6]), ([0.3,0.4],[0.4,0.5],[0.6,0.7]), \\ ([0.4,0.5],[0.5,0.6],[0.5,0.6]), ([0.5,0.5],[0.6,0.7],[0.4,0.5]), ([0.4,0.5],[0.5,0.6],[0.5,0.6]) \end{pmatrix},$$
$$\begin{pmatrix} ([0.7,0.8],[0.2,0.3],[0.2,0.3]), ([0.8,0.9],[0.1,0.2],[0.1,0.2]), ([0.3,0.4],[0.4,0.5],[0.6,0.7]), \\ ([0.4,0.5],[0.5,0.6],[0.5,0.6]), ([0.3,0.4],[0.4,0.5],[0.6,0.7]), ([0.4,0.5],[0.5,0.6],[0.5,0.6]), \\ ([0.3,0.4],[0.4,0.5],[0.6,0.7]), ([0.4,0.5],[0.5,0.6],[0.5,0.6]), ([0.3,0.4],[0.4,0.5],[0.6,0.7]) \end{pmatrix},$$
$$\left. \begin{pmatrix} ([0.1,0.2],[0.1,0.2],[0.8,0.9]), ([0.2,0.3],[0.3,0.4],[0.7,0.8]), ([0.3,0.4],[0.4,0.5],[0.6,0.7]), \\ ([0.3,0.4],[0.4,0.5],[0.6,0.7]), ([0.5,0.5],[0.6,0.7],[0.4,0.5]), ([0.5,0.6],[0.5,0.6],[0.4,0.5]), \\ ([0.6,0.7],[0.4,0.5],[0.3,0.4]), ([0.3,0.4],[0.4,0.5],[0.6,0.7]), ([0.8,0.9],[0.1,0.2],[0.1,0.2]) \end{pmatrix} \right\}$$

Then we convert these values into one value. Then we combine these values into one matrix.

Step 2. Then we used Eq. (6) to obtain the normalized decision matrix as:

$$x_{ij} = \left\{ \begin{array}{c} \left(\begin{array}{c} 0.398230088,0.12962963,0, \\ 0,1,1,\ 0,911949686,0.328767123,0.289719626 \end{array} \right), \\ \left(\begin{array}{c} 0.536873156,0.24382716,0.524590164, \\ 0.439597315,0.189655172,0,0,0.315068493,0.252336449 \end{array} \right), \\ \left(\begin{array}{c} 0.442477876,0.450617284,0.765027322,1, \\ 0.431034483,0.387931034,0.509433962,0.630136986,0.133956386 \end{array} \right), \\ \left(\begin{array}{c} 0.849557522,0.358024691,1,0.322147651, \\ 0.189655172,0.043103448,0.371069182,0,0.224299065 \end{array} \right), \\ \left(\begin{array}{c} 1,1,0.016393443, \\ 0.503355705,0,0.224137931,0.603773585,0.068493151,0 \end{array} \right), \\ \left(\begin{array}{c} 0,0,0.229508197, \\ 0.439597315,0.310344828,0.469827586,1,1,1 \end{array} \right), \end{array} \right\}$$

Then we compute the criteria weights as:

C1= 0.113226969
C2= 0.117279979
C3= 0.101646938
C4= 0.094698919
C5= 0.111747298
C6= 0.115864642
C7= 0.105378281
C8= 0.127959341
C9= 0.112197633

We show that criteria 8 is the best and criteria 4 has the lowest weight in nine criteria.

Step 3. Then we used Eq. (8) to determine the marginal utility score as:

$$r_{ij} = \left\{ \begin{array}{c} \left(\begin{array}{c} 0.712091716,0.173081727,0,0, \\ 3.736290116,3.736290116, \\ 3.038579999,0.543875725,0.459086079 \end{array} \right), \\ \left(\begin{array}{c} 1.126504039,0.367539074,1.084976457, \\ 0.823952529,0.269752319,0,0, \\ 0.513372985,0.383885149 \end{array} \right), \\ \left(\begin{array}{c} 0.832091919,0.855345926,2.116040461, \\ 3.736290116,0.800032195, \\ 0.68565154,1.035121096,1.477419584,0.179668484 \end{array} \right), \\ \left(\begin{array}{c} 2.613511891,0.61189061,3.736290116, \\ 0.529031788,0.269752319,0.052650192, \\ 0.643521745,0,0.331061496 \end{array} \right), \\ \left(\begin{array}{c} 3.736290116,3.736290116,0.019491402, \\ 1.015547771,0,0.330766391, \\ 1.371502458,0.085855227,0 \end{array} \right), \\ \left(\begin{array}{c} 0,0,0.340653009,0.823952529, \\ 0.503047078,0.911753695,3.736290116, \\ 3.736290116,3.736290116 \end{array} \right), \end{array} \right\}$$

Step 4. Then we compute the final utility score as:

$$P_{ij} = \left\{ \begin{array}{l} \left(\begin{array}{c} 0.080627986,0.020299021,0, \\ 0,0.417520325,0.432903918, \\ 0.320200337,0.06959398,0.051508371 = 1.392653938 \end{array} \right), \\ \left(\begin{array}{c} 0.127550637,0.043104975,0.110284534,0.078027414, \\ 0.030144093,0,0,0.065690869, \\ 0.043071005 = 0.497873527 \end{array} \right), \\ \left(\begin{array}{c} 0.094215246,0.100314953,0.215089033,0.353822636, \\ 0.089401436,0.07944277,0.109079282,0.189049637, \\ 0.020158379 = 1.250573371 \end{array} \right), \\ \left(\begin{array}{c} 0.295920029,0.071762518,0.379782449,0.050098739, \\ 0.030144093,0.006100296,0.067813215,0, \\ 0.037144316 = 0.938765654 \end{array} \right), \\ \left(\begin{array}{c} 0.423048804,0.438192028,0.001981241,0.096171276, \\ 0,0.03832413,0.144526571, \\ 0.010985978,0 = 1.153230029 \end{array} \right), \\ \left(\begin{array}{c} 0,0,0.034626335,0.078027414,0.056214152, \\ 0.105640016,0.39372383,0.478093222, \\ 0.419202905 = 1.565527874 \end{array} \right), \end{array} \right\}$$

Step 5. Then we rank alternatives.

A6>A1>A3>A5>A4>A2

4.1 Results and discussion

The evaluation of the quality of Party building work in universities in the new era is a crucial means to enhance the level of Party work, ensuring effective implementation of political, ideological, and organizational construction. The evaluation emphasizes political construction, requiring universities to consistently uphold Party leadership and enhance political awareness and responsibility among Party members and students through systematic education and training.

Ideological construction is another key aspect. Universities should innovate in ideological and political education, using modern technologies to make these efforts more appealing and effective. Diverse activities help deepen students' and faculty's understanding and acceptance of Party theories and policies. In terms of organizational construction, the evaluation focuses on institutionalizing and standardizing Party organizations to ensure their role as strongholds. By establishing sound organizational systems and scientific management mechanisms, the cohesion and effectiveness of Party organizations are enhanced. Additionally, the evaluation system emphasizes the integration of Party work with university education, teaching, and research management. Universities should leverage the exemplary role of Party members, guiding them to embody the Party's mission in their daily work and promoting steady development across all university initiatives. Finally, quality evaluation serves not only as an assessment of current efforts but also as guidance for future work. Through regular feedback and adjustments, the Party work mechanisms are continuously improved, ensuring universities remain at the forefront of the era, providing solid political and organizational

support for cultivating talented individuals with integrity and ability.

When implementing the proposed model, we can apply these steps.

Input: interval valued neutrosophic numbers with three opinions of experts and decision makers.
Computations:
Step 1. Obtain the criteria weights by the average method.
Step 2. Normalize the decision matrix.
Step 3. Then we compute the marginal utility score.
Step 4. Compute the utility score.
Step 5. Rank the alternatives to select the best one.

4.2. Comparative analysis

The INN-MAUT approach was thoroughly compared with the INN-EDAS approach [19] and the INN-TODIM approach [20]. The results of this comparison are presented in Table 1. This analysis shows that while the approaches may rank options slightly differently, they consistently identify the same best and worst local universities. This suggests that the INN-MAUT approach is a valid and effective method.

Compared to traditional methods and their improvements, the INN-MAUT approach has a key advantage: by using interval neutrosophic sets (INSs), it handles uncertainty more effectively. This is especially important for complex tasks like evaluating the quality of university party-building work, where there is a lot of ambiguity. INSs allow evaluators to express their opinions more accurately, even when faced with uncertainty. This approach provides a more nuanced way to deal with imprecise data, making sure that all uncertainties are considered during the evaluation process.

Table 1. Order for different approaches

Method	Order	Optimal	Worst
INN-EDAS approach [19]	A6>A1>A3>A4>A5>A2	A6	A2
INN-TODIM approach[20]	A6>A1>A4>A5>A3>A2	A6	A2
INN-TOPSIS approach	A6>A1>A3>A5>A4>A2	A6	A2
INN- MAUT approach	A6>A1>A3>A5>A4>A2	A6	A2

5. Conclusions and Future Scope

In the new era, the evaluation of the quality of party-building work in colleges focuses on the organic integration of political, ideological, and organizational aspects. Firstly, political construction is central, ensuring the effective implementation of the Party's leadership in universities by enhancing the political awareness of party members and faculty through education and training. Secondly, ideological construction emphasizes innovation and effectiveness, utilizing modern technology to enrich educational methods and enhance recognition of the Party's theories and policies. Organizational construction requires well-established grassroots party organizations and standardized systems to enhance organizational cohesion and combat effectiveness. Additionally, party-building work needs to be deeply integrated with education and teaching, leveraging the exemplary role of party members to promote comprehensive development in teaching and research. Through the comprehensive evaluation of these indicators, universities can continuously enhance the scientific and effective nature of party-building work. The quality evaluation of university party building work in the new era is a MAGDM problem. Recently, the MAUT method has been

employed to tackle MAGDM issues effectively. In this context, INSs are utilized to represent and manage uncertain data during the quality evaluation of university party-building work in the new era, providing a more flexible and comprehensive approach to handling uncertainty. In this study, we propose the development of an INN-MAUT approach to introduce an enhanced MAGDM technique under the framework of INSs. This approach allows for better decision-making in scenarios where uncertainty plays a significant role. Furthermore, the average method is applied to determine the weights of various decision criteria, utilizing the INSs framework to ensure that the influence of uncertainty is accurately captured in the weighting process. To demonstrate the practicality and effectiveness of the proposed INN-MAUT approach, a numerical example is provided, focusing on the application of this method to quality evaluation of university party building work in the new era. This example validates the approach by showing how it can improve decision-making and enhance the overall security assessment process.

In the future study, the proposed model can be applied to different decision-making problems to rank the alternatives and compute the criteria weights. Different methods can be applied to this kind of problem such as TOPSIS, VIKOR, and EDAS methods.

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