ISSN: 2309-5288 (Print)
ISSN: 2309-6152 (Online)
CODEN: JCLMC4
Journal of Coastal Life Medicine

Selection of a student for Annual Excellence Award: An application of Trapezoidal Fuzzy AHP

Received: 24 October 2022, **Revised:** 26 November 2022, **Accepted:** 29 December 2022

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Key words
Analytical Hierarchy Process, Fuzzy AHP, Extended Extent Analysis Method, Trapezoidal fuzzy number.

Abstract
Performance evaluations and awards have a tremendous impact on attracting, motivating, and maintaining talented students at educational institutions. Using an objective, systematically constructed reward system would be a just and fair approach to distribute awards. This paper aims to present a Fuzzy AHP Extended Extent Analysis Method for selecting a student for the annual excellence award for the academic year 2021–2022. Six criteria and six alternatives were taken into account in this case study. A trapezoidal fuzzy number is used to evaluate the outcomes and order the criteria according to weights when comparing these criteria pairwise. Buckley used trapezoidal fuzzy numbers to indicate the decision-assessment maker's options in relation to each criterion. The results of this study can be used to formally recognize and reward outstanding students. Additionally to increasing system openness, this would motivate students to produce results that the institution cares about. This paper presents the Excellence Award for Students in Educational Institutions using the Analytical Hierarchy Process.

1. Introduction

Numerous sectors, including education, business, management, research, and technology, among others, face Multi-criteria decision-making (MCDM) difficulties that combine qualitative and quantitative factors. The quantitative MCDM methods are insufficient to account for human decisions, particularly in the fields of capital budgeting decisions, risk analysis, GIS applications, agriculture, water resource management, resource allocation, energy planning, and environmental applications. The Analytical Hierarchy Process (AHP), Fuzzy AHP, Elimination and Choice Expressing Reality, Preference Ranking Organization Method for Enrichment Evaluation (PROMETHEE), and Simple Multi-Attribute Rating Technique (SMART) are just a few of the MCDM methods that have been proposed by researchers so far. AHP was widely used in these techniques to solve numerous issues in the actual world. Saaty TL[13] invented AHP, which is used to solve a variety of real-world problems and drew the attention of numerous academics due to its straightforward mathematical features. Authors referred [12] to comprehend decision-making basics and prioritization theory. In this approach, the weights of the decision alternatives are determined by placing the decision criteria in a hierarchical sequence. Numerous Fuzzy AHP techniques were proposed in decision-making. Among these, Chang DY's, Extent analysis method on Fuzzy AHP[3] was well-liked and used to solve many real-world issues by determining the weights of different options. Effective incentive

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programs can boost an organization's performance[15], [6]. Researchers have found that performance based reward system can inspire and is an important instrument to promote students' potentials and talents [5], [11].

In this case study, Vaagdevi Degree College, Warangal has been considered to grant annual excellence award for the selection of a best student—one among the students studying B.Sc-M.P.C(Mathematics, Physics, Chemistry), M.P.Cs(Mathematics, Physics, Computer Science), M.St.Cs(Mathematics, Statistics, Computer Science), M.E.Cs(Mathematics, Electronics, Computer Science), M.C.Cs(Mathematics, Chemistry, Computer Science), M.P.E(Mathematics, Physics, Electronics)-as alternatives for the year 2021–2022. For the purpose of awarding this prize, six criteria—academics, sports, co-curricular activities, communication skills, aptitude/reasoning skills and soft skills were identified. Here, a new scale was built utilizing trapezoidal fuzzy numbers and used the FAHP extended analysis approach to calculate weights using trapezoidal fuzzy numbers with six criteria and six alternatives while choosing a student for the annual excellence award.

2. Literature Review

The idea of Effective Organizational Justice and Organizational Citizenship Behavior[2] and Influence of performance appraisal fairness and job satisfaction through commitment on job performance[14], is emulated in assessing student's academic performance and commitment. The right evaluation of a student's performance and recognition positively affect his/her performance in academics, co-curricular and extra-curricular activities. It is reflected through their academic commitment and in their pursuit of excellence.

AHP is applied for selection of a student in an Engineering college who is eligible for All Round Excellence Award for the year 2004-05 by taking subjective judgments of decision maker in [7], [8]. Authors also reviewed FAHP approach with Trapezoidal Fuzzy Numbers in finding Alternatives for Student Absenteeism in Engineering Colleges[10], to understand usage of trapezoidal fuzzy numbers instead of triangular fuzzy number in Chang extent analysis method on Fuzzy AHP, because trapezoidal fuzzy numbers pose several advantages over triangular fuzzy numbers as they are more generalized form.

Trapezoidal Fuzzy Number $A = (a, b, c, d)$ is defined as

$$\mu_A(x) = \begin{cases} \frac{x-a}{b-a}, a \le x \le b \\ 1, \quad b \le x \le c \\ \frac{x-d}{c-d}, c \le x \le d \\ 0, \quad otherwise \end{cases}$$

Table 1 describes about Trapezoidal Fuzzy Scale.

Crisp No.	Trapezoidal Fuzzy Number	Compare factor
1	(1, 1,1, 1)	Equally importance
3	(1,2, 4, 5)	Moderate importance
5	(3, 4, 6, 7)	Strong importance
7	(5, 6, 8, 9)	Very strong importance
9	(7, 8, 10,11)	Extreme importance
1/3	(1/5, 1/4, 1/2, 1)	Weak importance
1/5	(1/7, 1/6, 1/4, 1/3)	Less importance
1/7	(1/9, 1/8, 1/6, 1/5)	Very less importance
1/9	(1/11, 1/10, 1/8, 1/7)	Extreme less importance
2, 4, 6, 8	-	Intermediate values

Table 1: Trapezoidal Fuzzy Scale

3. Case study

The Vaagdevi Degree College in Warangal offers a Bachelor of Science degree course with about 440 intake of the students in the six programs viz.-M.P.C, M.P.Cs, M.St.Cs, M.E.Cs, M.C.Cs, and M.P.E. for the present paper. The B.Sc. graduating class of this institution for the academic year 2021–2022 was considered as case study. The Vaagdevi Degree College was established in 1993 at Warangal. This is a Co-Educational college affiliated to Kakatiya University.

4. Physical importance of each Criteria

Academics(C_1): The student's cumulative grade point average should be consistently higher than 75% throughout the duration of the course.

Sports(C_2): A student must compete in sports such as those offered during intra-college or inter-college competitions and win prizes.

Co-Curricular activities(C_3): A student must take part in co-curricular activities such as paper presentations, debates, group discussions, quizzes,

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ISSN: 2309-6152 (Online)
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etc., whether they are inter-college or intra-college, and they must place well in order to receive rewards.

Communication skills(C_4): To improve their communication abilities, students must take part in competitions and compete for awards.

Aptitude/Reasoning skills(C_5): To improve their aptitude and thinking abilities, students must take part in several competitions and compete for awards.

Soft skills(C_6): In order to develop their soft skills, students must take part in competitions and compete for awards.

5. Physical importance of each Alternative

The graduating class of B.Sc. students of Vaagdevi degree college, with the six specializations in 2021–2022 was considered.

M.P.C(Mathematics, Physics, Chemistry)(A_1): B.Sc M.P.C is a highly sought-after and prestigious degree program offered at the graduate level and is the undergraduate degree of choice for scientific students. In addition to the physical sciences and engineering, mathematics also has a wide range of applications in the social, management, and life sciences.

M.P.Cs(Mathematics, Physics, Computer Science)(A_2): One of the most well-liked programs in the IT industry is B.Sc M.P.Cs. A student's career may advance if he/she works in this area. As the business and demand expand, there are numerous job opportunities in India and overseas in this steadily expanding profession.

M.St.Cs(Mathematics, Statistics and Computer Science)(A_3): The aim of this course are made to guarantee that it achieves its goal of teaching students a broad foundation in a variety of mathematics and computing science while avoiding overspecialization and giving them a good range of possibilities.

M.E.Cs(Mathematics, Electronics and Computer Science)(A_4): As part of the course's primary goal, students will learn numerous concepts that aid in the development of logical models and tools that may be utilized to solve a variety of real-world situations.

M.C.Cs(Mathematics, Chemistry, Computer Science)(A_5): B.Sc, M.C.Cs is fundamentally altering the way we perceive the world by creating new applications in science, engineering, and business. Students who complete this program will be prepared to make a contribution to this fascinating profession that is rapidly changing.

M.P.E(Mathematics, Physics, Electronics)(A_6): A three year undergraduate program B.Sc M.P.E concentrates on the study of communications, Analog electronics, electromagnetic, engineering materials, and mathematics. This program tries to educate viewers on the various devices' functions and intended uses.

6. Methodology

Triangular Fuzzy Numbers were developed by Laarhoven and Pedrycz[9] in Fuzzy AHP. Extent Analysis method on Fuzzy AHP was proposed by Chang DY[3]. This approach was used in a variety of real-world situations. Triangular Fuzzy Numbers were used in this manner to reflect the opinions of experts. A system was devised to express the opinions of the experts as Trapezoidal Fuzzy Numbers since Trapezoidal Fuzzy Numbers were a more general form when compared to Triangular Fuzzy Numbers.

According to Abhinav Bansal[1], the arithmetic operators for trapezoidal fuzzy numbers are:

Let $\tilde{M}_1 = (e_1, f_1, g_1, h_1)$ and $\tilde{M}_2 = (e_2, f_2, g_2, h_2)$ be two trapezoidal fuzzy numbers then

$$\tilde{M}_1 + \tilde{M}_2 = (e_1, f_1, g_1, h_1) + (e_2, f_2, g_2, h_2) = (e_1 + e_2, f_1 + f_2, g_1 + g_2, h_1 + h_2) \quad \text{(i)}$$

$$\tilde{M}_1 \otimes \tilde{M}_2 = (e_1, f_1, g_1, h_1) \otimes (e_2, f_2, g_2, h_2) = (e_1 e_2, f_1 f_2, g_1 g_2, h_1 h_2) \quad \text{(ii)}$$

$$\tilde{M}_1^{-1} = \left(\frac{1}{h_1}, \frac{1}{g_1}, \frac{1}{f_1}, \frac{1}{e_1}\right) \quad \text{(iii)}$$

6.1 Extended Extent Analysis Method:

The matrix for each level of hierarchy is

$$\tilde{A} = (\tilde{a}_{ij})_{n\times n} = \begin{bmatrix} (1,1,1,1) & (e_{12}, f_{12}, g_{12}, h_{12}) & \cdots & (e_{1n}, f_{1n}, g_{1n}, h_{1n}) \\ (e_{21}, f_{21}, g_{21}, h_{21}) & (1,1,1,1) & \cdots & (e_{2n}, f_{2n}, g_{2n}, h_{2n}) \\ \vdots & \vdots & \ddots & \vdots \\ (e_{n1}, f_{n1}, g_{n1}, h_{n1}) & (e_{n2}, f_{n2}, g_{n2}, h_{n2}) & \cdots & (1,1,1,1) \end{bmatrix}$$

where $\tilde{a}_{ij} = (e_{ij}, f_{ij}, g_{ij}, h_{ij})$ and $\tilde{a}_{ij}^{-1} = \left(\frac{1}{h_{ij}}, \frac{1}{g_{ij}}, \frac{1}{f_{ij}}, \frac{1}{e_{ij}}\right), i = 1,2, \ldots, n; j = 1,2, \ldots, n.$

This represents the judgments for the alternatives and criteria.

First Step: Fuzzy synthetic extent value with respect to i^{th} object is defined as

ISSN: 2309-5288 (Print)
ISSN: 2309-6152 (Online)
CODEN: JCLMC4
Journal of Coastal Life Medicine

$$\tilde{S}_i = \frac{RS_i}{\sum_{j=1}^{n} RS_j} = \left(\frac{\sum_{j=1}^{n} e_{ij}}{\sum_{j=1}^{n} e_{ij} + \sum_{k=1,k\neq i}^{n}\sum_{j=1}^{n} h_{ij}}, \frac{\sum_{j=1}^{n} f_{ij}}{\sum_{j=1}^{n} f_{ij} + \sum_{k=1,k\neq i}^{n}\sum_{j=1}^{n} g_{kj}}, \frac{\sum_{j=1}^{n} g_{ij}}{\sum_{j=1}^{n} g_{ij} + \sum_{k=1,k\neq i}^{n}\sum_{j=1}^{n} f_{kj}}, \frac{\sum_{j=1}^{n} h_{ij}}{\sum_{j=1}^{n} h_{ij} + \sum_{k=1,k\neq i}^{n}\sum_{j=1}^{n} e_{kj}}\right)$$

------- (1)

To obtain RS_i, perform the fuzzy addition operation of n extent analysis values for a particular matrix such that

$$RS_i = \sum_{j=1}^{n} \tilde{a}_{ij} = \left(\sum_{j=1}^{n} e_{ij}, \sum_{j=1}^{n} f_{ij}, \sum_{j=1}^{n} g_{ij}, \sum_{j=1}^{n} h_{ij}\right)$$

Second Step: As $\widetilde{M}_1 = (e_1, f_1, g_1, h_1)$ and $\widetilde{M}_2 = (e_2, f_2, g_2, h_2)$ are the two trapezoidal fuzzy numbers, the possible degree of $\widetilde{M}_2 = (e_2, f_2, g_2, h_2) \geq \widetilde{M}_1 = (e_1, f_1, g_1, h_1)$ is defined as

$$V(\widetilde{M}_2 \geq \widetilde{M}_1) = \sup_{y \geq x}\left(\min\left(\mu_{\widetilde{M}_1}(x), \mu_{\widetilde{M}_2}(y)\right)\right) \quad \text{------- (2)}$$

It is equivalent to, $V(\widetilde{M}_2 \geq \widetilde{M}_1) = hgt(\widetilde{M}_2 \cap \widetilde{M}_1) =$

$$\mu_{\widetilde{M}_2}(d) = \begin{cases} 1, & if\, g_2 \geq f_1 \\ 0, & if\, e_1 > h_2 \\ \frac{e_1 - h_2}{e_1 - h_2 + g_2 - f_1}, & Otherwise \end{cases}$$

Figure 1 explains the intersection between two trapezoidal fuzzy numbers $\widetilde{M}_1$ and $\widetilde{M}_2$.

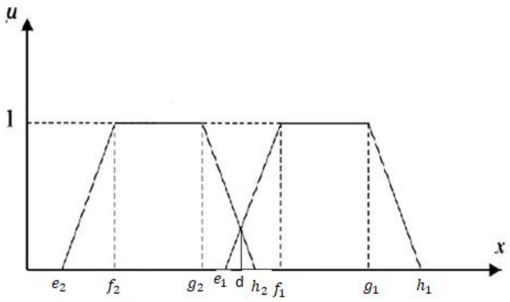

Figure 1: Intersection between $\widetilde{M}_2$ and $\widetilde{M}_1$

Third Step: A possible degree for convex fuzzy numbers is defined by

$$V(M \geq M_1, M_2, M_3, \ldots, M_k) = V\lfloor (M \geq M_1) and (M \geq M_2) and \ldots (M \geq M_k) \rfloor = MinV(M \geq M_i), i = 1,2, \ldots, k \quad \text{..........(3)}$$

Suppose $d'(A_i) = MinV(S_i \geq S_k), k = 1,2, \ldots, n; k \neq i$

Weight vector is $W' = \left(d'(A_1), d'(A_2), d'(A_3), \ldots, d'(A_n)\right)^T$ ....(4)

Fourth Step: The normalized vectors via normalization are

$$W = \left(d(A_1), d(A_2), d(A_3), \ldots, d(A_n)\right)^T$$ ------- (5)

where $d(A_1) = \frac{d'(A_1)}{\sum_{i=1}^{n} d'(A_i)}, d(A_2) = \frac{d'(A_2)}{\sum_{i=1}^{n} d'(A_i)}, \ldots, d(A_n) = \frac{d'(A_n)}{\sum_{i=1}^{n} d'(A_i)}$. Here W is a non-fuzzy number.

7. Results

Table 2 displays the combined pair wise comparison matrix of all the expert opinions. In the pair wise comparison, this demonstrates the criteria that are more dominant than the others. The consolidated pair wise comparison matrix was used to generate the criteria weights, which are shown in Table 3. The relative importance of each criterion in respect to the others is shown by these criteria weights. Table 3 also shows the ranking of the criterion based on the criteria weights. Table 4 to Table 7 shows weights of alternatives with respect to Criteria 3 to Criteria 6 respectively. Table 8 shows weights of all Criteria.

Notations: n=size of the matrix=6, Consistency Index=CI $= \frac{\lambda_{max} - n}{n-1}$ where λ_{max} is the largest eigen value of the matrix of size n, RI= Ratio Index=1.24 for 6X6 matrix, Consistency Ratio= CR $= \frac{CI}{RI}$.

C1	M.P.C	M.P.Cs	M.St.Cs	M.E.Cs	M.C.Cs	M.P.E	Normalized weight vector
M.P.C	(1,1,1,1)	(1,2,4,5)	(1/5,1/4,1/2,1)	(1/5,1/4,1/2,1)	(1/7,1/6,1/4,1/3)	(1/9,1/8,1/6,1/5)	0.009
M.P.Cs	(1/5,1/4,1/2,1)	(1,1,1,1)	(1/5,1/4,1/2,1)	(1/7,1/6,1/4,1/3)	(1/7,1/6,1/4,1/3)	(1/9,1/8,1/6,1/5)	0.000
M.St.Cs	(1,2,4,5)	(1,2,4,5)	(1,1,1,1)	(1/5,1/4,1/2,1)	(1/5,1/4,1/2,1)	(1/7,1/6,1/4,1/3)	0.137
M	(1,2,	(3,	(1,2,	(1,1,	(1/5,	(1/5,	0.2

ISSN: 2309-5288 (Print)
ISSN: 2309-6152 (Online)
CODEN: JCLMC4
Journal of Coastal Life Medicine

.E.Cs	4,5)	4, 6, 7)	4,5)	1,1)	1/4,1/2,1)	1/4,1/2,1)	75
M.C.Cs	(3, 4, 6, 7)	(3, 4, 6, 7)	(1,2, 4,5)	(1,2, 4,5)	(1,1, 1,1)	(1/5, 1/4,1/2,1)	0.29
M.P.E	(5, 6, 8, 9)	(5, 6, 8, 9)	(3, 4, 6, 7)	(1,2, 4,5)	(1,2, 4,5)	(1,1, 1,1)	0.29

$\lambda_{\max} = 6.395$, CI = 0.079, RI = 1.24, CR = 0.0637

Table 2: Fuzzy options showing weights of alternatives with respect to Criteria 1

C2	M.P.C	M.P.Cs	M.St.Cs	M.E.Cs	M.C.Cs	M.P.E	Normalized weight vector
M.P.C	(1, 1, 1, 1)	(1, 1, 1, 1)	(1/5, 1/4,1/2,1)	(1/7, 1/6,1/4,1/3)	(1/5, 1/4,1/2,1)	(1/7, 1/6,1/4,1/3)	0.001
M.P.Cs	(1, 1, 1, 1)	(1, 1, 1, 1)	(1/5, 1/4,1/2,1)	(1/5, 1/4,1/2,1)	(1/5, 1/4,1/2,1)	(1/7, 1/6,1/4,1/3)	0.026
M.St.Cs	(1, 2, 4, 5)	(1, 2, 4, 5)	(1,1, 1,1)	(1/5, 1/4,1/2,1)	(1/5, 1/4,1/2,1)	1/5,1/4,1/2, 1)	0.223
M.E.Cs	(3, 4, 6, 7)	(1, 2, 4, 5)	(1,2, 4,5)	(1,1,1,1)	(1,1, 1,1)	1/5,1/4,1/2, 1)	0.250
M.C.Cs	(1, 2, 4, 5)	(1, 2, 4, 5)	(1,2, 4,5)	(1,1,1,1)	(1,1, 1,1)	1/5,1/4,1/2, 1)	0.250
M.P.E	(3, 4, 6, 7)	(3, 4, 6, 7)	(1,2, 4,5)	(1,2,4,5)	(1,2, 4,5)	(1,1,1,1)	0.250

$\lambda_{max} = 6.279$, $CI = 0.0558$, $RI = 1.24$, $CR = 0.045$

Table 3: Fuzzy options showing weights of alternatives with respect to Criteria 2

C3	M.P.C	M.P.Cs	M.St.Cs	M.E.Cs	M.C.Cs	M.P.E	Normalized weight vector
M.P.C	(1,1, 1,1)	(1/5, 1/4,1/2,1)	(1/5, 1/4,1/2,1)	(1,2, 4,5)	(1, 2, 4, 5)	(3,4, 6,7)	0.304
M.P.Cs	(1,2, 4,5)	(1,1, 1,1)	(1,1, 1,1)	(1,2, 4,5)	(1, 2, 4, 5)	(5,6, 8,9)	0.304
M.St.Cs	(1,2, 4,5)	(1,1, 1,1)	(1,1, 1,1)	(3, 4, 6, 7)	(5, 6, 8, 9)	(3,4, 6,7)	0.304
M.E.Cs	(1/5, 1/4,1/2,1)	(1/5, 1/4,1/2,1)	(1/7, 1/6,1/4,1/3)	(1,1, 1,1)	(1, 1, 1, 1)	(1,2, 4,5)	0.074
M.C.Cs	(1/5, 1/4,1/2,1)	(1/5, 1/4,1/2,1)	(1/9, 1/8,1/6,1/5)	(1,1, 1,1)	(1, 1, 1, 1)	(1/5, 1/4, 1/2, 1)	0.000
M.P.E	(1/7, 1/6,1/4,1/3)	(1/9, 1/8,1/6,1/5)	(1/7, 1/6,1/4,1/3)	(1/5, 1/4, 1/2, 1)	(1, 2, 4, 5)	(1,1, 1,1)	0.015

$\lambda_{max} = 6.577$, $CI = 0.1154$, $RI = 1.24$, $CR = 0.09306$

Table 4: Fuzzy options showing weights of alternatives with respect to Criteria 3

C4	M.P.C	M.P.Cs	M.St.Cs	M.E.Cs	M.C.Cs	M.P.E	Normalized wei

ISSN: 2309-5288 (Print)
ISSN: 2309-6152 (Online)
CODEN: JCLMC4
Journal of Coastal Life Medicine

							ght vector
M.P.C	(1,1,1,1)	(1/4,1/3,1,1)	(0,1,3,4)	(1,2,4,5)	(3,4,6,7)	(5,6,8,9)	0.248
M.P.Cs	(0,1,3,4)	(1,1,1,1)	(1,2,4,5)	(2,3,5,6)	(3,4,6,7)	(5,6,8,9)	0.248
M.St.Cs	(1/4,1/3,1,1)	(1/5,1/4,1/2,1)	(1,1,1,1)	(0,1,3,4)	(1,2,4,5)	(3,4,6,7)	0.248
M.E.Cs	(1/5,1/4,1/2,1)	(1/6,1/5,1/3,1/2)	(1/4,1/3,1,1)	(1,1,1,1)	(0,1,3,4)	(1,2,4,5)	0.184
M.C.Cs	(1/7,1/6,1/4,1/3)	(1/7,1/6,1/4,1/3)	(1/5,1/4,1/2,1)	(1/4,1/3,1,1)	(1,1,1,1)	(0,1,3,4)	0.171
M.P.E	(1/9,1/8,1/6,1/5)	(1/9,1/8,1/6,1/5)	(1/7,1/6,1/4,1/3)	(1/5,1/4,1/2,1)	(1/4,1/3,1,1)	(1,1,1,1)	0.000

$\lambda_{max} = 6.10205$, $CI = 0.02041$, $RI = 1.24$, $CR = 0.01645$

Table5: Fuzzy options showing weights of alternatives with respect to Criteria 4

C_5	**M.P.C**	**M.P.Cs**	**M.St.Cs**	**M.E.Cs**	**M.C.Cs**	**M.P.E**	**Normalized weight vector**
M.P.C	(1,1,1,1)	(1,1,1,1)	(0,1,3,4)	(2,3,5,6)	(1,2,4,5)	(3,4,6,7)	0.191
M.P.Cs	(1,1,1,1)	(1,1,1,1)	(0,1,3,4)	(1,2,4,5)	(1,2,4,5)	(2,3,5,6)	0.191
M.St.Cs	(1/4,1/3,1,1)	(1/4,1/3,1,1)	(1,1,1,1)	(0,1,3,4)	(0,1,3,4)	(0,1,3,4)	0.191
M.E.Cs	(1/6,1/5,1/3,1/2)	(1/5,1/4,1/2,1)	(1/4,1/3,1,1)	(1,1,1,1)	(1,1,1,1)	(0,1,3,4)	0.166
M.C.Cs	(1/5,1/4,1/2,1)	(1/5,1/4,1/2,1)	(1/4,1/3,1,1)	(1,1,1,1)	(1,1,1,1)	(0,1,3,4)	0.171
M.P.E	(1/7,1/6,1/4,1/3)	(1/6,1/5,1/3,1/2)	(1/4,1/3,1,1)	(1/4,1/3,1,1)	(1/4,1/3,1,1)	(1,1,1,1)	0.089

$\lambda_{max} = 6.058$, $CI = 0.0116$, $RI = 1.24$, $CR = 0.0093$

Table6: Fuzzy options showing weights of alternatives with respect to Criteria 5

C_6	**M.P.C**	**M.P.Cs**	**M.St.Cs**	**M.E.Cs**	**M.C.Cs**	**M.P.E**	**Normalized weight vector**
M.P.C	(1,1,1,1)	(1,1,1,1)	(1,2,4,5)	(2,3,5,6)	(1,2,4,5)	(2,3,5,6)	0.206
M.P.Cs	(1,1,1,1)	(1,1,1,1)	(1,2,4,5)	(1,1,1,1)	(2,3,5,6)	(1,2,4,5)	0.206
M.St.Cs	(1/5,1/4,1/2,1)	(1/5,1/4,1/2,1)	(1,1,1,1)	(1/5,1/4,1/2,1)	(1,1,1,1)	(2,3,5,6)	0.192
M.E.Cs	(1/6,1/5,1/3,1/2)	(1,1,1,1)	(1,2,4,5)	(1,1,1,1)	(1,2,4,5)	(3,4,6,7)	0.206
M.C.Cs	(1/5,1/4,1/2,1)	(1/6,1/5,1/3,1/2)	(1,1,1,1)	(1/5,1/4,1/2,1)	(1,1,1,1)	(2,3,5,6)	0.188
M.P.	(1/6,1/5,1	(1/5,1/4,1	(1/6,1/5,1	(1/7,1/6,1	(1/6,1/5,1	(1,1,	0.000

ISSN: 2309-5288 (Print)
ISSN: 2309-6152 (Online)
CODEN: JCLMC4
Journal of Coastal Life Medicine

E	/3,1/2)	/2,1)	/3,1/2)	/4,1/3)	/3,1/2)	1,1)	

$\lambda_{max} = 6.514, \quad CI = 0.1028, \quad RI = 1.24, \quad CR = 0.0829$

Table7: Fuzzy options showing weights of alternatives with respect to Criteria 6

	C_1	C_2	C_3	C_4	C_5	C_6	Normalized weight vector
C_1	(1,1,1,1)	(1/4,1/3,1,1)	(0,1,3,4)	(2,3,5,6)	(2,3,5,6)	(5,6,8,9)	0.247
C_2	(0,1,3,4)	(1,1,1,1)	(1,2,4,5)	(3,4,6,7)	(3,4,6,7)	(6,7,9,10)	0.247
C_3	(1/4,1/3,1,1)	(1/5,1/4,1/2,1)	(1,1,1,1)	(0,1,3,4)	(0,1,3,4)	(2,3,5,6)	0.214
C_4	(1/6,1/5,1/3,1/2)	(1/7,1/6,1/4,1/3)	(1/4,1/3,1,1)	(1,1,1,1)	(1,1,1,1)	(1,2,4,5)	0.054
C_5	(1/6,1/5,1/3,1/2)	(1/7,1/6,1/4,1/3)	(1/4,1/3,1,1)	(1,1,1,1)	(1,1,1,1)	(1/5,1/4,1/2,1)	0.000
C_6	(5,6,8,9)	(1/10,1/9,1/7.1/6)	(1/6,1/5,1/3,1/2)	(1/5,1/4,1/2,1)	(1,2,4,5)	(1,1,1,1)	0.237

$\lambda_{max} = 6.476, \quad CI = 0.0952, \quad RI = 1.24, \quad CR = 0.0767$

Table 8: Fuzzy options showing weights of all Criteria

	0.247 C_1	0.247 C_2	0.214 C_3	0.054 C_4	0.000 C_5	0.237 C_6	Weights	Ranking
A_1	0.009	0.001	0.304	0.248	0.191	0.206	0.1297	VI
A_2	0.000	0.026	0.304	0.248	0.191	0.206	0.1336	V
A_3	0.137	0.223	0.304	0.248	0.191	0.192	0.2128	I
A_4	0.275	0.250	0.074	0.184	0.166	0.206	0.2042	II
A_5	0.29	0.250	0.000	0.171	0.171	0.188	0.1871	III
A_6	0.29	0.250	0.015	0.000	0.089	0.000	0.1365	IV

Table 9: Ranking of Alternatives

8. Conclusion

This study applies AHP to a multi-criteria decision-making problem with the goal of prioritizing the requirements for a system of student annual excellence awards. It initially established several criteria that might be used to gauge student achievement, and it then used AHP to order the criteria based on the opinions of experts. The findings of this study can be utilized to formally identify and honor exceptional students. This would not only increase system transparency but would also encourage students to reach the outcomes that the institution sets for them. The AHP application described in this study could be made available to other institutions for comparable purposes. The criteria and their priority weights may change, but the approach will remain the same.

The outcomes from AHP show that the criteria(consistency ratio<0.1) are prioritized with consistency of judgment. Consistency in judgment proves the soundness of the judgment's priority[4]. As a result, the suggested priority weights and ranking from this study can be regarded as accurate and reliable for evaluating the institution's annual excellence awards. B.Sc M.St.Cs is the most crucial criterion for the yearly excellence award, according to the ordering of the criteria weights.

9. Acknowledgment

The management of Vaagdevi Degree College, Muffakham Jah College of Engineering and Technology, Anurag University and Guru Nanak Institutions Technical Campus are gratefully acknowledged by the authors for their active engagement in facilitating this work.

ISSN: 2309-5288 (Print)
ISSN: 2309-6152 (Online)
CODEN: JCLMC4
Journal of Coastal Life Medicine

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