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EVALUATION OF UNIVERSITIES SERVICES BY USING FUZZY ANALYTICAL HIERARCHY PROCESS

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ABSTRACT: The objective of this paper is to assess the level of students' satisfaction about services that will be very beneficial for policymakers and institutes for improvement in education sector. To determine students' satisfaction indices for the actual services for learning process in universities, the study adopted samples, a total of 350 responses were collected from university campus and the data was analyzed using Fuzzy Analytical Hieratical Process FAHP. For the purposes of the survey, questionnaires were constructed considers all the factors may be affecting in students' satisfaction and were taken according to their suitable priority. There were five main dimensions in the questionnaires. dimension one was administrative university services Si, the second dimension was teaching and learning process Ti, while the third dimension is university climate and student activities Ai, the fourth dimension covers the administrative facilities Fi, and the fifth dimension is learning facilities students Li, were asked to measure their perceived experiences with those criterions. Each main dimension contains some of sub criteria. The results illustrate that the students' counseling services and Academic Advising A2, the toilet facilities F3, and opportunities for recreational activitiesA1, and providing equal opportunities of learning T3 are the most satisfaction for the student about the university services.

KEYWORDS: Fuzzy AHP, weights of criteria, Attributing Factors, Students' Class Evaluation, Customer satisfaction, customer loyalty.

1. INTRODUCTION

Modern research studies investigating teaching and learning, as they take place under the unique conditions presented in college and university classrooms, have yielded a number of valuable insights. The findings mainly reflect two major themes. The first is that despite the influence of factors that lie beyond the control of professors and instructors, such as students' backgrounds and previous learning experiences, the quality of their teaching has a very strong effect on students' learning. In other words, college teachers do make a difference. Instructional factors under their direct control have a very important and powerful influence on what students learn, and on the success they achieve in college level courses. The second major theme is that college students who have successful learning experiences persist in their learning and are far more likely to complete the courses and programs in which they enroll.

In this competitive environment only those institutions can excel which are providing the quality education and constructive environment to their students, since these factors can influence their choice of admission. Such factors can satisfy students to their institutions and can affect their decisions to attend. There has been an increasing emphasis on the study of student satisfaction in colleges and universities in all over the word. The satisfaction surveys provide universities with real pictures of the key issues perceived by their students. Consequently, the satisfaction results from the questionnaire surveys have been used as feedback information to help university administrators and faculty to enhance the quality of programs and services. Therefore, there is a need to identify and develop the main attributing factors for students' overall satisfaction in class that might enable the large majority of students to be satisfied in the learning process.

Once identified, this information could be shared with all educators interested in improving the quality of teaching and learning.

The formulated a model comprising of one internal factor and six external factors, as independent variables, which were assumed to have an impact on student satisfaction.

1. Internal Factor: Students preparation
2. External factors: Education, Safety, Image and prestige, Social and cultural support, Infra-structure and admin support, Economic consideration

Different statistical methods used to analyze the students satisfaction level with different focuses. This paper mainly aims to understand the differences in students' perception towards service quality rendered to them. Moreover, it discusses the conceptual basis of student satisfaction and perceived quality and explores the relationship between service quality and student satisfaction.

2. LITERATURE REVIEW

A brief literature review related to students' satisfaction are:

Anantha Raj A. Arokiasamy, and Abdul Ghani bin Abdullah, found that student's satisfaction assessment is vital in determining service quality at higher learning institutions. To remain competitive with other private higher education providers, it is important that the institution continuously acquire, maintain, build stronger relationships and assess the level of students' satisfaction. This study measures the level of student satisfaction with current services offered by Malaysian university colleges.

M. Bevilacqua, and M. Braglia, introduced an application of the Analytic Hierarchy Process (AHP) for selecting the best maintenance strategy for an important Italian oil refinery (an Integrated Gasification and Combined Cycle plant). Five possible alternatives are considered: preventive, predictive, condition-based, corrective and opportunistic maintenance. With AHP technique, several aspects, which characterize each of the above-mentioned maintenance strategies, are arranged in a hierarchic structure and evaluated using only a series of pairwise judgments.

Thomas L. Saaty, believes that decisions involve many intangibles that need to be traded off. To do that, they have to be measured a long side tangibles whose measurements must also be evaluated as to, how well, they serve the objectives of the decision maker. The Analytic Hierarchy Process (AHP) is a theory of measurement through pairwise comparisons and relies on the judgments of experts to derive priority scales. It is these scales that measure intangibles in relative terms. The judgments may be inconsistent, and how to measure inconsistency and improve the judgments, when possible to obtain better consistency is a concern of the AHP. The derived priority scales are synthesized by multiplying them by the priority of their parent nodes and adding for all such nodes.

Chiang Ku Fan, and Shu Wen Cheng, analyzed the most appropriate curricula for students in departments of risk management and insurance from the perspective of life insurance companies in Taiwan. They proposed a curriculum performance evaluation method combining the Analytical Hierarchy Process (AHP) and the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS).

Serkan Ball and Serdar Korukoğlu, developed a fuzzy decision model to select appropriate operating system for computer systems of the firms by taking subjective judgments of decision makers into consideration. Proposed approach is based on Fuzzy Analytic Hierarchy Process (FAHP) and TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) methods. FAHP method is used in determining the weights of the criteria by decision makers and then rankings of the operating systems are determined by TOPSIS method. Empirical study has also been demonstrated.

3. ANALYTIC HIERARCHY PROCESS AHP

The analytic hierarchy process (AHP) is one of the most widely-used multi attribute decision-making (MADM) methods. A set of statements covering qualitative attributes is constructed. For example, the performance of an information technology company for developing an E-business system can be described

on a five-point scale as 'very low,' 'low,' 'medium,' 'high,' and 'very high.' To score the scale, a five-point scale with 1, 2, 3, 4, or 5 is credited, which is corresponding from 'very low' to 'very high.' Sometimes, a more detailed scale such as seven-point or nine-point scale might be applied depending on the decision problem context. The intervals between statements are meaningful but scale scores have no meaning. For example, a scale system of (3, 5, 7, 9 and 11) can be utilized instead of (1, 2, 3, 4, and 5).

3.1. Normalization of Attribute Ratings

There are two popular normalization methods used in the MADM methods:

1) Linear normalization

$$\boldsymbol{r_{ij} = \frac{x_{ij}}{x_j^*} \qquad i = 1, \dots, m;\ j = 1, \dots, n} \qquad \textbf{(1)}$$

where x^* is the maximum value of the *j*th attribute when maximum is the better.

2) Vector normalization

$$\boldsymbol{r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^2}}} \qquad \textbf{(2)}$$

There are five principles must be followed when criteria are being formulated:

(1) Completeness,
(2) Operationally,
(3) Decomposability,
(4) Non-redundancy,
(5) Minimum size.

4. FUZZY ANALYTIC HIERARCHY PROCESS (FAHP)

Fuzzy AHP is developed to resolve the expanded hierarchical problems of ordinary AHP. Considering that the fuzzy logic method is applied for decision making in uncertain and ambiguous situations.

Fuzzy set theory: Fuzzy set theory has more advantages in describing set concepts in human language than traditional set theory. It demonstrates the unspecific and fuzzy characteristics of language through evaluation and uses a membership function concept to represent the field in which a fuzzy set can permit situations such as incompletely belonging to and incompletely not belonging to. Currently, the practical applications reported in the literature have indicated the advantages of fuzzy set theory for acquiring more precise and subjective results. For this reason, to avoid possible objective scoring by senior sample experts, fuzzy set theory has been incorporated into the expert questionnaire.

Fuzzy number: We order the Universe of Discourse such that *U* is a whole target that we discuss, and each target in the Universe of Discourse is called an element. We have fuzzy $\tilde{A}$, which on *U* states that random $X \to U$appointing a real number $\mu_{\tilde{A}}(x) \to [0,1]$. We call anything above that level of *X under A*. The universe of real number *R* is a triangular fuzzy number (TFN):$\tilde{A}$, which means $X \epsilon R$, appointing $\mu_{\tilde{A}}(x) \in [0,1]$, and

$$\mu_{\tilde{A}}(X) = \begin{cases} \frac{X-L}{M-L} & L \le X \le M \\ \frac{U-X}{U-M} & M \le X \le U \\ 0 & otherwise \end{cases} \qquad (3)$$

The triangular fuzzy number above can be shown as $\tilde{A} = (L; M; U)$, where *L* and *U* represent fuzzy probabilities between the lower and upper boundaries of evaluation information, as shown in Figure 4.1. Assume two fuzzy numbers, $\tilde{A}_1 = (L1; M1; U1)$, and $\widetilde{A_2} = (L2; M2; U2)$; then

$\tilde{A}_1 \oplus \tilde{A}_2 = (L1, M1, U1) \oplus (L2, M2, U2) = (L1 + L2, M1 + M2, U1 + U2)$ where $L_i > 0, M_i > 0, U_i > 0$ (4)

$\tilde{A}_1 \otimes \tilde{A}_2 = (L1, M1, U1) \otimes (L2, M2, U2) = (L1L2, M1M2, U1U2)$ where $L_i > 0, M_i > 0, U_i > 0$ (5)

$\tilde{A}_1 \ominus \tilde{A}_2 = (L1, M1, U1) \ominus (L2, M2, U2) = (L1 - L2, M1 - M2, U1 - U2)$ where $L_i > 0, M_i > 0, U_i > 0$ (6)

$\tilde{A}_1 \div \tilde{A}_2 = (L1, M1, U1) \div (L2, M2, U2) = (L1/L2, M1/M2, U1/U2)$ where $L_i > 0, M_i > 0, U_i > 0$ (7)

$((A)\tilde{}\_1)^{-1} = (L1, M1, U1)^{-1} = (1/L1, 1/M1, 1/U1)$ where $L_i > 0, M_i > 0, U_i > 0$ (8)

Note that other forms of the membership function can be easily employed by using the same procedures.

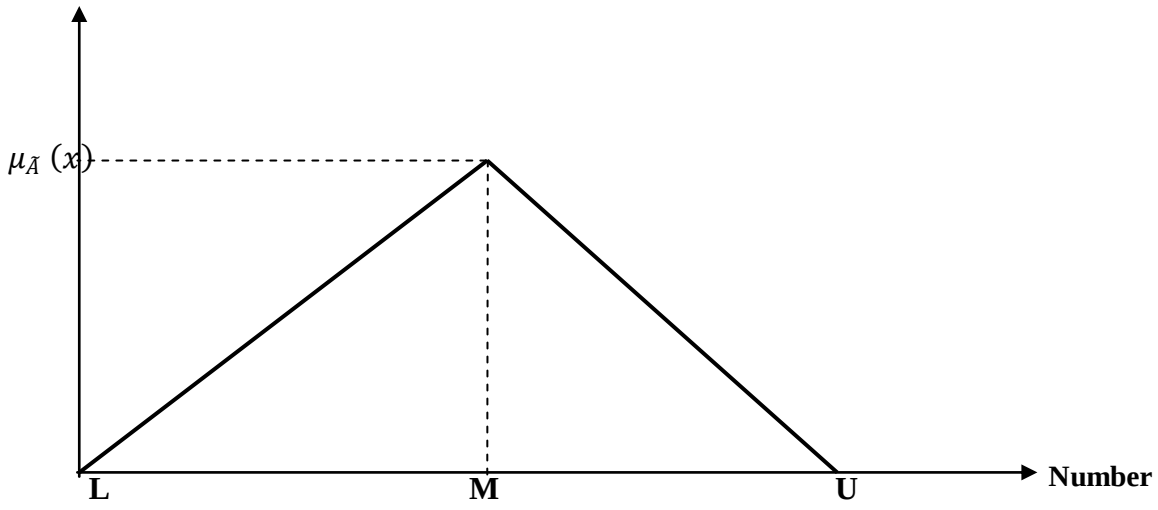

Figure 1: Triangular Fuzzy Number (Membership Function)

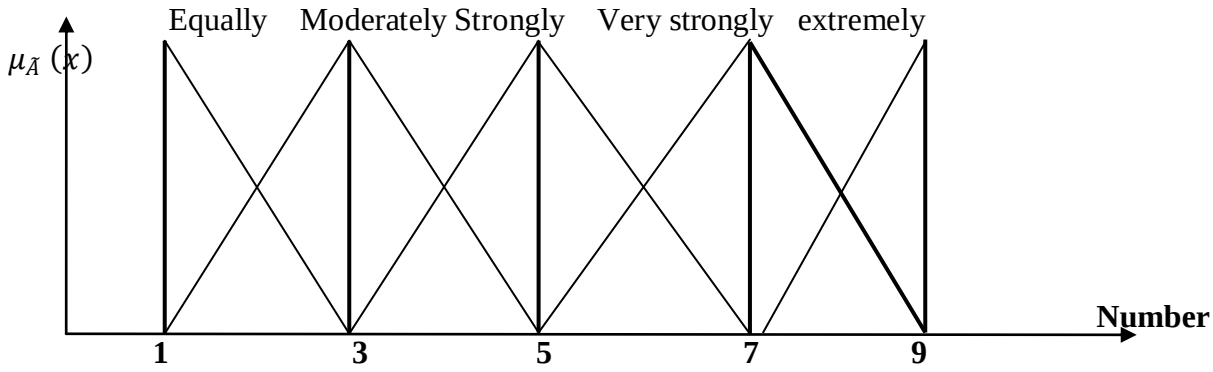

Figure 2: Fuzzy Membership Function for Linguistic Values

Table 1: Definition and Membership Function Of Fuzzy Numbers

Fuzzy Number	Linguistic variable	Triangular Fuzzy Number
$\tilde{9}$	Extremely important	(7,9,9)
$\tilde{7}$	Very strongly important	(5,7,9)
$\tilde{5}$	strongly important	(3,5,7)
$\tilde{3}$	Moderately important	(1,3,5)
$\tilde{1}$	Equal important	(1,1,3)

Fuzzy logic: is a form of multi-valued logic derived from fuzzy set theory to deal with reasoning that is approximate rather than precise. In contrast with "crisp logic", where binary sets have binary logic, fuzzy logic variables may have a truth value that ranges between 0 and 1 and is not constrained to the two truth values of classic propositional logic.[1] Furthermore, when linguistic variables are used, these degrees may be managed by specific functions. Though fuzzy logic has been applied to many fields, from control theory to artificial intelligence, it still remains controversial among most statisticians, who prefer Bayesian logic, and some control engineers, who prefer traditional two-valued logic.

Fuzzy linguistic variable: The fuzzy linguistic variable is a variable that reflects the different levels of human language. Its value represents the range from natural to artificial language. When one precisely reflects the value or meaning of a linguistic variable, there must be an appropriate way to change. Variables for a human word or sentence can be divided into numerous linguistic criteria, such as equally important, moderately important, strongly important, very strongly important, and extremely important, as shown in Figure 2, with definitions and descriptions as shown in Table 1. For the purpose of the present study, the 5-point scale (i.e., equally important, moderately important, strongly important, very strongly important and extremely important) is used.

4.1 Calculation steps of FAHP

The 4-step procedure of this approach is given as follows:

Step 1: Comparing the performance score

Assuming *K* experts (student), we proceed to decision-making on *P* alternatives with *n* criteria.

Step 2: Construct fuzzy comparison matrix

We use a triangular fuzzy number to represent the meaning of questionnaires, and we construct positive reciprocal matrices.

Step 3: Exam consistency of fuzzy matrix

Assume that $A = [aij]$ is a positive reciprocal matrix and $\widetilde{\boldsymbol{A}} = [\widetilde{\boldsymbol{a}}ij\ ]$ is a fuzzy positive reciprocal matrix. If $A = [aij\ ]$ is consistent, then $\widetilde{\boldsymbol{A}} = [\widetilde{\boldsymbol{a}}ij\ ]$ will be consistent also.

Step 4: Calculate fuzzy evaluation of number $\tilde{\boldsymbol{r}}$

$$\tilde{\boldsymbol{r}} = [\widetilde{\boldsymbol{a}}_{\boldsymbol{i1}} \otimes \dots\dots\dots\otimes \widetilde{\boldsymbol{a}}_{\boldsymbol{in}}]^{\boldsymbol{1/n}} \qquad \textbf{(9)}$$

Step 5: Calculate fuzzy weight $\widetilde{W}i$

$$\widetilde{\boldsymbol{W}}_{\boldsymbol{i}} = \tilde{\boldsymbol{r}}_{\boldsymbol{i}} \otimes [\tilde{\boldsymbol{r}}_{\boldsymbol{i1}} \otimes \dots\dots\dots\otimes \tilde{\boldsymbol{r}}_{\boldsymbol{im}})^{\boldsymbol{-1}} \qquad \textbf{(10)}$$

Fuzzy logic is a rule-based system written in the form of horn clauses (*i.e.*, if-then rules). These rules are stored in the knowledge base of the system. The input to the fuzzy system is a scalar value that is fuzzified.

Step 6: Defuzzy

5. CASE STUDY

The higher education sector has been undergoing profound transformation during last decade. A well known university was taken for case study. Government has provided numerous incentives to both students and faculty with the collaboration of local and international institutions in terms of scholarships. The Higher Education Commission not only encourages the students for higher studies but also equips the universities for providing the quality education. These education reforms have already led to a remarkable growth and competition in higher education sector of Middle East. Although this is a positive sign for a developing the institutions to meeting the demand of the market for qualified individuals with specialization in various fields as a result of industrial growth in the country. However, increased costs and greater competition among institutions require at national and international level that they should adopt a market orientation strategy to differentiate their services from the competitors in order to increase enrolments and attract students. The focus on quality in higher education is comparatively recent and the subject of student satisfaction has not been explored much.

Questioners were distributed in seven colleges, college of engineering, college of medicine, college of science, college of computers and informatics, college of dentistry, faculty of administrative & financial sciences, and college of sharia were charged with the task of increasing understanding of students concerns and making recommendations for improvements.

5.1 Questionnaire Design

For the purposes of the survey, a questionnaire was constructed. This questionnaire considers all the factors affecting in student satisfaction and most probably all these factors are taken according to their suitable priority. The questionnaires (n = 350) were administered during the first semester of the academic year 2016. The questionnaire was self-completed anonymously and the time given to complete the entire questionnaire was approximately 20 min. A total of 350 questionnaires were considered for statistical analysis. There were five main dimensions in the questionnaires. dimension one focuses on administrative university services Si, the second dimension concentrate with teaching and learning process Ti, while the third dimension is university climate and student activities Ai, the fourth dimension covers the administrative facilities Fi, and the fifth dimension is learning facilities students Li, were asked to measure their perceived experiences with those dimensions. Each dimension contains some of sub criteria. Students were asked to measure their perceived experiences with those criteria.

5.2 Study Methodology

In this paper an AHP-FUZZY methodology submitted for satisfaction measurement students. There are many uncertainties, vagueness's, and imprecisions in the real world when dealing with decisions of multiple criteria. Fuzzy set theory treats a kind of uncertainty called fuzziness. It shows that the boundary of "yes" or "no" is ambiguous and appears in the meaning of words or included in the subjunctives or recognition of human beings. The following dimensions represent the student satisfaction and importance.

1. Administrative University Services S:
   - 1.1 Services Deanship of Admission S1
   - 1.2 Services Deanship of Student Affairs S2
   - 1.3 Assessment procedures fair and transparent S3
   - 1.4 Appropriate recognition for star students S4
2. Teaching and Learning Process T
   - 2.1 The quality of teachers T1
   - 2.2 Generally student friendly and focus on specific individual needs T2.
   - 2.3 Providing equal opportunities of learning T3
   - 2.4 Access out of the class to meet my remedial needs (Office Hours) T4.
   - 2.5 Scientific and moral support T5
   - 2.6 Fair evaluation for student T6
3. University Climate and Student activities A
   - 3.1 Opportunities for recreational activities A1
   - 3.2 The students' counseling services and Academic Advising A2
   - 3.3 Remedial support A3
   - 3.4 Respect here regardless my family A4
4. Administrative Facilities F
   - 4.1 Transportation facilities F1
   - 4.2 Hygienic and affordable food (Cafeteria and Restaurant) F2
   - 4.3 The toilet facilities F3
   - 4.4 Updated of all the university relevant news through Advertisements board (university journal)F4
5. Learning Facilities L
   - 5.1 Classrooms well equipped with educational resources L1
   - 5.2 Information Technology IT labs well equipped to meet students' need L2
   - 5.3 University's library L3

5.4 Classroom for group study L4
5.5 Training during study L5
5.6 Training during summer L6

5.3 Student's Satisfaction

The purposed Study was to investigate the nature and source of student satisfaction and dissatisfaction with the quality of undergraduate instruction and non-instructional services.

A plan developed for the Student Satisfaction Study included five major activities:

1. Reviewing existing survey data available.
2. Reviewing related literature
3. Collecting and analyzing additional information as necessary
4. Making questioner about student satisfaction , then analyze by fuzzy AHP method
5. Making recommendations and indicate for improvements.

The customer satisfaction for the main factors Administrative University Services Si, Teaching and Learning Process Ti, University Climate and Student activities Ai, Administrative Facilities Fi, and Learning Facilities Li are illustrates in Table 2.

Table 2: Relative Student and Fuzzy Ranking

Fuzzy #	1	3	5	7	9	F.W	Rank
Voters	Not.	M	S	V. S	Ex.		
S	98	95	98	32	27	3.828	5
T	118	68	89	47	28	3.851	3
A	78	86	90	55	41	4.40	1
F	103	63	82	59	43	4.291	2
L	125	69	80	35	41	3.845	4

Table 3: Linguistic Satisfaction Matrix for Main Dimensions

Index	S	T	A	F	L
S	Equal	1/S	1/Ext.	1/V. S	1/M
T	Strongly	Equal	1/S	1/M	Moderately
A	Ext.	Strongly	Equal	Moderately	V. Strongly
F	V. Strongly	Moderately	1/Moderately	Equal	Strongly
L	Moderate	1/M	1/V. S	1/S	Equal

Table 4: Membership functions for Main Dimensions

Di	**S**	**T**	**A**	**F**	**L**
S	1,1,3	1/(3,5,7)	1/(7,9,9)	1/(5,7,9)	1/(1,3,5)
T	3,5,7	1,1,3	1(3,5,7)	1/(1,3,5)	1,3,5
A	7,9,9	3,5,7	1,1,3	1,3,5	5,7,9
F	5,7,9	1,3,5	1/(1,3,5)	(1,1,3)	3,5,7
L	1,3,5	1/(1,3,5)	1/(5,7,9)	1/(3,5,7)	1,1,3

$\lambda max = 5.237475, C.I = 0.059369, R.I = 1.11,$ and $CR = 0.053485$

Table 5: Fuzzy Weights and BNPW for Student' Satisfaction

Factors	U	M	L	BNPW
S	0.06326	0.03291	0.02308	0.03975
T	0.16047	0.12957	0.11319	0.13441
A	0.55505	0.51003	0.40705	0.49071
F	0.27582	0.26383	0.25923	0.26629
L	0.09336	0.06363	0.04942	0.0688

Table 6: Administrative University Services Criteria (Si)

Si	1	3	5	7	9	Fuzzy. W	Rank
	Not.	M	S	V.S	Ex.		
S1	110	74	75	35	56	4.16	2
S2	68	74	79	93	36	4.742	1
S3	119	78	73	41	39	3.874	3
S4	122	68	78	53	29	3.851	4

Table 7: Linguistic Satisfaction of Administrative University Services (Si)

Si	S1	S2	S3	S4
S1	Equal	1/M	Moderately	Strongly
S2	Moderately	Equal	Strongly	V. Strongly
S3	1/M	1/S	Equal	Moderately
S4	1/S	1/V. S	1/M	Equal

Table 8: Membership functions of Administrative University Services (Si)

Si	S1	S2	S3	S4
S1	1,1,3	1,1/3,1/5	(1,3,5	3,5,7
S2	1,3,5	1,1,3	(3,5,7)	5,7,9
S3	1,1/3,1/5	(1/3,1/5,1/7)	(1,1,3)	1,3,5
S4	1/3,1/5,1/7	1/5,1/7,1/9	1,1/3,1/5	1,1,3

$\lambda max = 4.116978, C.I = 0.038993, R.I = 0.89,$ and $CR = 0.043812$

Table 9: Fuzzy weights and BNPW for Administrative University Services (Si)

Si	U	M	L	BNP
S1	0.289118	0.263378	0.243077	0.265191
S2	0.629575	0.563813	0.432332	0.541907
S3	0.166922	0.117786	0.091875	0.125528
S4	0.111628	0.055022	0.035473	0.067374

Table 10: Student Satisfaction for Teaching and Learning Process

Satisfaction	No	M	S	V.S.	Ext.	Fuzzy W.	Rank
T1	122	68	71	54	35	3.925	5
T2	106	73	83	49	39	4.097	4
T3	106	74	59	48	63	4.360	1
T4	88	94	75	55	38	4.205	3
T5	125	80	54	54	37	3.845	6
T6	85	77	107	47	34	4.245	2

Table 11: Linguistic Satisfaction Matrix for Teaching and Learning

Ti	T1	T2	T3	T4	T5	T6
T1	Equal	1/M	1/V. V. S	1/S	M	1/V. S
T2	Moderately	Equal	1/V.S	1/M	Strong	1/S
T3	V. V. S	V.Strong	Equal	Strong	Extremely	Moderate
T4	Strong	Moderate	1/S	Equal	Strong	1/M.
T5	1/M	1/S	1/Ex.	1/S	Equal	1/V. V. S
T6	V.Strong	Strong	1/M	Moderately	V. V. S	Equal

Table 12: Membership functions for Relative Student' Teaching and Learning Process Ti

Ti	T1	T2	T3	T4	T5	T6
T1	1,1,3	1/(1,3,5)	1/(6,8,9)	1/(3,5,7)	1,3,5	1/(5,7,9)
T2	1,3,5	1,1,3	1/(5,7,9)	1/(1,3,5)	3,5,7	1/(3,5,7)
T3	6,8,9	5,7,9	1,1,3	3,5,7	7,9,9	1,3,5
T4	3,5,7	1,3,5	1/(3,5,7)	1,1,3	3,5,7	1/(1,3,5)
T5	1/(1,3,5)	1/(3,5,7)	1/(7,9,9	1/(3,5,7)	1,1,3	1/(6,8,9)
T6	5,7,9	3,5,7	1/(1,3,5)	1,3,5	6,8,9	1,1,3

λmax= 6.476975 , CI=0.095394966, RI=1.25, CR=0.076315973

Table 13: Fuzzy Weights and BNPW of Student' Satisfaction Teaching and Learning Process (Ti)

Ti	Ui	Mi	Li	BNPW
T1	0.06013	0.04052	0.03183	0.044165
T2	0.09735	0.07493	0.0635	0.078599
T3	0.49691	0.45916	0.37275	0.442945
T4	0.15289	0.13553	0.12666	0.138364
T5	0.04734	0.02474	0.01761	0.029897
T6	0.2695	0.26509	0.26348	0.266029

Table 14: Student Satisfaction for University Climate and Student Activities

Ai	Not	M	S	V.S	Ex.	Fuzzy.W	Rank
A1	116	92	78	29	35	3.714286	2
A2	106	86	69	39	50	4.091429	1
A3	142	69	79	32	28	3.485714	4
A4	127	94	53	41	35	3.645714	3

Table 15: Linguistic Importance Matrix for Climate and Student Activities

Ai	A1	A2	A3	A4
A1	Equal	1/Moderate	Strong	Moderate
A2	Moderate	Equal	V. Strongly	Strong
A3	1/ S	1/V. Strong	Equal1̃	1/ M
A4	1/ M	1/ S	Moderate	Equal

Table 16: Fuzzy Matrix for satisfaction of Climate and Student Activities

Ai	A1	A2	A3	A4
A1	1,1,3	1/(1,3,5)	3,5,7	1,3,5
A2	1,3,5	(1,1,3)	5,7,9	3,5,7
A3	1/(3, 5,7)	1/(5, 7, 9)	(1,1,3)	1/(1, 3,5)
A4	1/(1, 3, 5)	1/(3, 5,7)	1,3,5	1,1,3

λmax=4.116985 , CI=0.038995, RI=0.89, CR=0.043814

Table 17: Fuzzy Weights and BNPW of Climate and Student Activities A

Ai	Ui	Mi	Li	BNP
A1	0.301192	0.263378	0.243077	0.269216
A2	0.629575	0.563813	0.450388	0.547925
A3	0.11629	0.055022	0.035473	0.068928
A4	0.13213	0.117786	0.091875	0.11393

Table 18: The Students Satisfaction for Administrative Facilities Fi

F.W	1	3	5	7	9	Fuzzy W	Rank
Fi	N	M	S	V. S	Ex.		
F1	153	68	73	27	29	3.348	4
F2	88	92	85	55	30	4.125	2
F3	73	94	67	48	68	4.68	1
F4	92	95	78	51	34	4.085	3

Table 19: Linguistic Satisfaction Matrix of Administrative Facilities Fi

Fi	F1	F2	F3	F4
F1	Equal	1/S	1/Ex	1/S
F2	Strongly	Equal	1/S	Moderately
F3	Extremely	Strongly	Equal	V.Strongly
F4	Strongly	1/M	1/V.S	Equal

Table 20: Fuzzy Matrix for Satisfaction of Administrative Facilities Fi

Fi	F1	F2	F3	F4
F1	1,1,3	1/(3, 5,7)	1/(7, 9,9)	1/(3, 5,7)
F2	3,5,7	1,1,3	1/(3, 5,7)	1,3,5
F3	7,9,9	3,5,7	1,1,3	(5,7,9)
F4	3,5,7	1/(1, 3,5)	1/(5, 7, 9)	1,1,3

λmax=4.3 ,CI=0.1, RI=0.89, CR=0.1124

Table 21: Fuzzy Weights and BNPW of Student' Satisfaction of Administrative Facilities Fi

Fi	Ui	Mi	Li	BNP
F1	0.065294	0.039811	0.030219	0.045108
F2	0.207074	0.20292	0.183954	0.197983
F3	0.67574	0.649565	0.588852	0.638052
F4	0.1619	0.107704	0.086967	0.118857

Table 22: The Students Satisfaction for Learning Facilities

Li	N	M	S	V. S	Ex	Fuzzy W.	Rank
L1	122	66	69	60	33	3.948	2
L2	131	80	67	45	27	3.611	3
L3	92	70	88	48	52	4.417	1
L4	210	100	36	4	0	2.051	6
L5	118	115	49	43	25	3.525	4
L6	151	76	57	40	26	3.365	5

Table 23: Linguistic Satisfaction Matrix of Learning Facilities

L	L1	L2	L3	L4	L5	L6
L11	Equal	Moderate	1/M	V.V. S	Strong	V. S
L2	1/M	Equal	1/ S	V. S	Moderate	Strong
L3	Moderate	Strong	Equal	Extreme	V.S	V.V. S

L4	1/V.V. S	1/V. S	1/ Ex	Equal	1./ S	1/M
L5	1/ S	1/M	1/V. S	Strong	Equal	Moderate
L6	1/V.S	1/ Strong	1/V.V. S	Moderate	1/ M	Equal

Table 24: Fuzzy Membership functions of Learning Facilities

Li	L1	L2	L3	L4	L5	L6
L11	1,1,3	1,3,5	1/(1,	6,8,9	3,5,7	5,7,9
L2	1/(1,3,5)	1,1,3	1/(3,5,7)	5,7,9	1,3,5	3,5,7
L3	1,3,5	3,5,7	1,1,3	7,9,9	5,7,9	6,8,9
L4	1/(6,8,9)	1/(5,7,9)	1/(1,9,9)	1,1,3	1/(3,5,7)	1/(1,3,5)
L5	1/(3,5,7)	1/(1,3,5)	1/(5,7,9)	3,5,7	1,1,3	1,3,5
L6	1/(5, 7,	1/(3,5,7)	1/(6,8,9)	1,3,5	1/(1,3,5)	1,1,3

λmax=6.480296, CI=0.09605921, RI=1.25, CR=0.076847

Table 25: Fuzzy Weights and BNPW Student' Satisfaction of Learning Facilities

Li	Ui	Mi	Li	BNP
L1	0.266914	0.263395	0.262249	0.264186
L2	0.164877	0.142429	0.131469	0.146258
L3	0.494594	0.456214	0.369165	0.439991
L4	0.043063	0.023245	0.0168	0.027703
L5	0.09642	0.074456	0.063204	0.078027
L6	0.05956	0.040261	0.031685	0.043836

Table 26: Students Satisfaction Indexes for Satisfaction Measureme

Dimension	Main Dimension	Sub-Criteria	Student satisfaction	Rank
Si	**0.039757**			
S1		0.265191	0.010543	16
S2		0.541907	0.021544	11
S3		0.125528	0.004991	20
S4		0.067374	0.002679	23
Ti	**0.134416**			
T1		0.044165	0.005936	18
T2		0.078599	0.010565	15
T3		0.442945	0.059539	4
T4		0.138364	0.018598	12
T5		0.029897	0.004019	21
T6		0.266029	0.035759	7
Ai	**0.490718**			
A1		0.269216	0.132109	3

A2		0.547925	0.268877	1
A3		0.068928	0.033824	8
A4		0.11393	0.055908	5
Fi	**0.266299**			
F1		0.045108	0.012012	14
F2		0.197983	0.052723	6
F3		0.638052	0.169913	2
F4		0.118857	0.031652	9
Li	**0.06881**			
L1		0.264186	0.018179	13
L2		0.146258	0.010064	17
L3		0.439991	0.030276	10
L4		0.027703	0.001906	24
L5		0.078027	0.005369	19
L6		0.043836	0.003016	22

CONCLUSION

The study adopted samples, a total of 350 responses were collected the data was analyzed using FAHP. The quality of teachers T1, Opportunities for recreational activities A1, and Fair evaluation for students T6 are the most important indexes.

The students' counseling services, Academic Advising, the toilet facilities, and opportunities for recreational activities are the most satisfaction indexes for the actual services. In this study, the integration of AHP with the fuzzy synthetic extent analysis method (fuzzy AHP) is proposed for customer satisfaction measurement in university sector as a framework to guide managers. There is a lack of research in the literature to deal directly with the uncertainty of human judgments in evaluating satisfaction costumers in university system. Therefore, fuzzy AHP is an appropriate methodology to select the various types of criteria and has the ability to be used as a decision-making analysis tool.

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