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Evaluating performance of technical institute using analytic hierarchy process

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ABSTRACT : The Education system in the country saw a revolution with the emergence of a whole new class of Education providers. It is very challenging and complex task to evaluate and compare performance of Technical Institutes in a group. This paper provides a framework and a system to the Educational policy makers and the performance monitoring committee for designing a standard multiple performance measurement tool for evaluating and comparing the performance of Technical Institutes of Madhya Pradesh often called the *Heart of India,* is a state in central India. In this paper decision support method known as Analytic Hierarchy Process (AHP) is applied to develop the relationship among performance measurement criteria, deriving their respective weights, then evaluate and rank selected Technical Institutes of Madhya Pradesh with respect to prescribed criterions. We focus on five Technical Institutes of the state, were subjected to 6 criterions and 24 sub criterions with diverse metrics, out of which 2 numbers are Government Institutes (Govt. added) and 3 numbers are Private Institutes (Self financing) which selected from 198 Technical Institute of Madhya Pradesh.

Keywords : Analytic Hierarchy Process (AHP), decision-making, Technical Education, performance measurement, performance measurement criteria

I. INTRODUCTION

The language of competition has been adopted in Education. Competition in the Technical Education industry is very fierce. Marketing has become increasingly important as Technical Institutions compete for the students and there has been a proliferation of glossy brochures, television advertising and other public relations activities. To gain competitive advantage Technical Education has resorted to various strategies [5].

Amidst the tremendous pressures faced by Educational Institutions, both from internal as well as from external forces, the Technical Educational Institutions in Madhya Pradesh, as elsewhere in the India, have begun to understand and accept the significance of self evaluation and comparisons with competitors.

Evaluating and comparing the performance of different Technical organizations in a group in the fairest way is a very complex and challenging task.In the past, many simple and complex decision support tools are available for more than 25 years but most of the tools have not been adopted and applied to support their decisions. AHP, since invention has been a tool at the hands of decision makers and researchers, it is one of the most widely used multiple criteria decision making (MCDM) tools [10]. The AHP is used in almost all application related to MCDM in the last 20 years [4]. AHP is a managerial tool that can be frequently applied to different decisions [2, 6].

In this article, the Analytic Hierarchy Process (AHP) is being studied as a simple and useful managerial tool that can be helpful for management in the selection of any Technical Institute that could be successful in the market. The proposed method has been used for selection of quality attributes in Technical Education setting.

In this study Analytic Hierarchy Process (AHP) is used to develop the relationship among performance measurement criteria and rank them by deriving their respective weights. Also AHP algorithm is solved on a hypothetical example consistent with the hierarchy developed to evaluate any Technical Institute.

II. EVALUATION FRAMEWORK

Many empirical studies have tried to measure different dimensions of service Industry. Technical Education Institutions are increasingly recognizing that Technical Education is a service industry, and are placing greater emphasis on meeting the expectations and needs of their participating customers, that is, the students [3]. The performance of an Institute is likely to be influenced many factors like infrastructure, administration, quality of the teacher, quality of the students, internal and external budget and many others. It is felt that quality and performance evaluation is necessary not only for appraisal but it is also required to improve overall service quality. In consideration of the above, the study highlights that service quality as a multi-attribute estimate. In this study, performance measurement criteria for the Technical Institute of Madhya Pradesh are selected on the basis of National Board of Accreditation (NBA), All India Council for Technical Education. NBA gives 8 criterions and 56 sub criterions out of which we are subjected to 6 criterions and 24 sub criterions. Our study investigated 6 criterions of service quality, namely: Physical resources, Human resources,

Financial Resources-Allocation and Utilization, Teaching – learning processes, Supplementary processes and Organization and governance.

Physical resource stands to the Infrastructure of the Institute, which includes buildings, laboratories, equipment, material, library and other ancillary facilities. Human resources refer to faculty and supporting staff. Financial Resources-Allocation and Utilization means financial resources should be adequate to sustain not only the achievement of current Educational objectives, but also provide for improvements in the foreseeable future and their allocation and utilization is in a proper planned way. Teaching – learning processes means Degree programmed should embody general and specialized professional content of adequate depth and breadth, and should include appropriate Humanities and Science components. The core of the main program should concentrate on acquisition of knowledge and skills in the specific discipline, and also ensure exposure to inter-disciplinary areas. There should also be an effective relationship between the curricular content and practice in the field of specialization. Supplementary processes stands for the institution should provide the environment, which fosters not only the intellectual, but also the personality development of its students. It should have personality development opportunities provided through co-curricular and extra-curricular activities and student services. These opportunities are to enable the students to become responsible members of the society. The services and facilities should be readily accessible to the students. Organization and Governance refers to the effectiveness and extent of achievement of goals depends on the commitment, attitude, planning and monitoring capacity, incentives and self-appraisal policies of the Management. Organization and Governance depend on the qualities of leadership, motivation, transparency of the operation, decentralization and delegation of powers, participation of faculty in the management, planning, and general efficiency indices (NBA manual).

In this study, Analytic Hierarchy Process (AHP) that was developed as an estimation and decision making technique for management is reviewed for the evaluation of any technical Institute on the basis of above 6 criterions. The AHP algorithm is solved on a hypothetical example consistent with the hierarchy developed to evaluate any technical college.

Fig.1 shows the Analytic Hierarchy Process (AHP) model used in this study to evaluate the service quality of five Technical Institutes of Madhya Pradesh.

III. ANALYTIC HIERARCHY PROCESS

Analytic hierarchy process can be defined as a decision and forecasting method giving the percentage distribution of decision points in terms of the factors affecting the decision. It is easy to evaluate the decision points in terms of any factor and reach a decision. However, making the decision gets harder as the number of factors to be evaluated increases. As a result, decision-makers need to consider all the evaluation factors together [1].

AHP has become preferred by decision-makers as a reliable tool since it ranks the evaluation factors according to their relative importance, then assesses the decision points for every factor and, finally, has a mathematical method combining these two stages. The stages of AHP are described below :

A. Structuring the decision hierarchy

Firstly, the decision points are determined. Then, the factors influencing a decision are described. The number of decision points is shown with "*m*" and the factors affecting the decision points are presented with "*n*".

B. Establishing a comparison matrix of the factors

The comparison matrix is a square matrix with *n* x *m* dimensions. The evaluation factors make up the rows and columns of the matrix. Using the relative importance scale, as shown in Table 1, makes the comparisons. Since the values on the diagonal represent the same factor, they become 1. If the preference is used in favour of the factor in the row when the factor in any row is compared with the factor in the column, fraction (1/importance value) is preferred [11]

Table 1 : Scale of relative importance.

Intensity of relative	Importance	Definition explanation
1	Equal Importance Level	Two elements have equal importance regarding the element in higher level
3	Week Dominance	Experience or judgment slightly favors one element
5	Strong Dominance	Experience or judgement strongly favours one element
7	Demonstrated	Dominance of one element proved in practice
9	Absolute Dominance	The highest order dominance of one element over another
2,4,6,8	Intermediate Values	Compromise is needed

C. Determining percentages for the importance distribution of the factors

The B row vector with $n \times 1$ dimensions is established by using row vectors building the comparison matrix for importance distribution.

$$Bi = .bij. \; n \times 1 \ldots, \; i = 1, 2, \ldots, n \ldots, \text{ Formula 1}$$

The components of this vector are calculated by using Formula 2, with the utilization of the elements of the comparison matrix (*aij*). In other words, the elements of the B row vector are calculated by dividing the elements in the lines of the comparison matrix with the row sums [7,8].

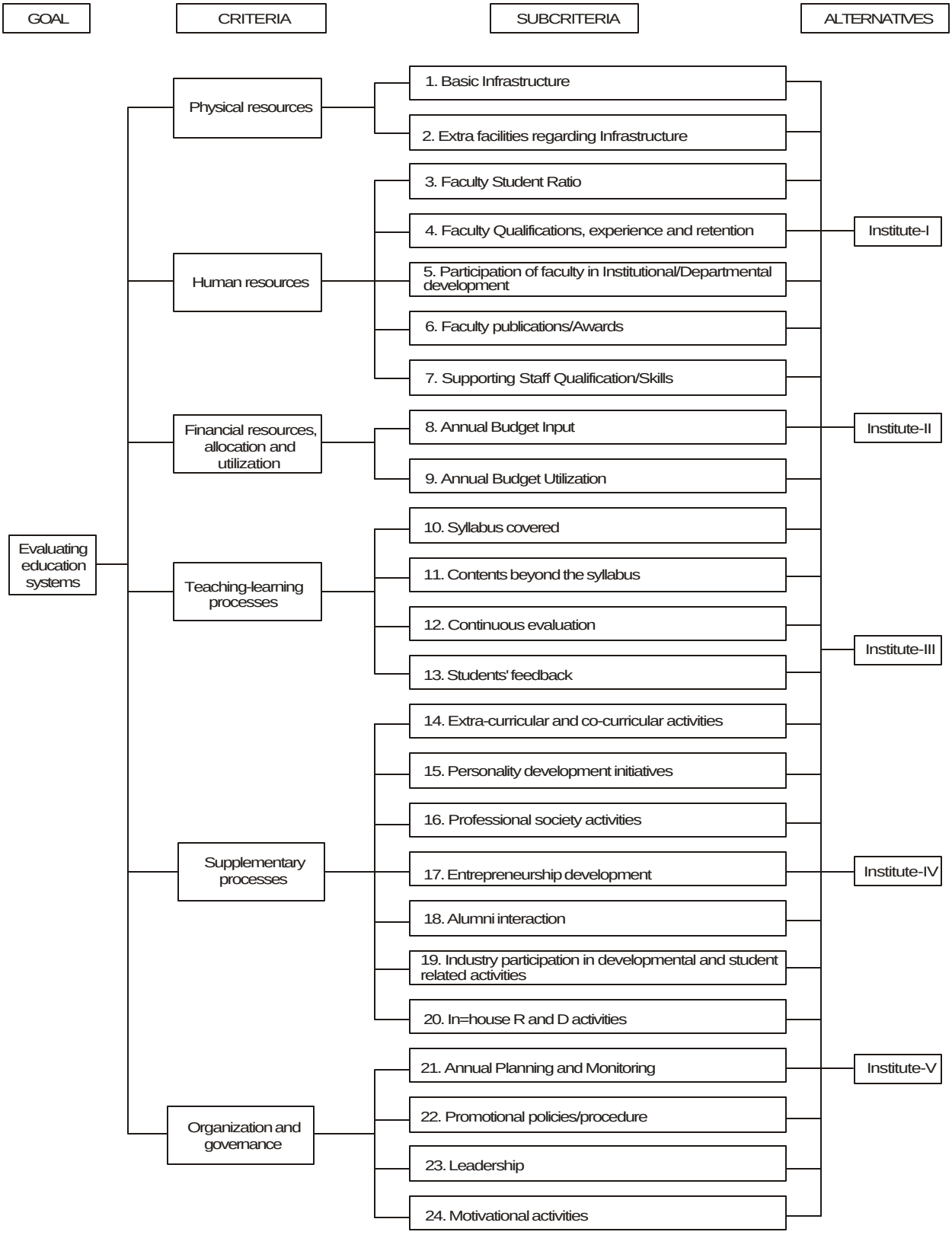

Fig.1. The model of technical college service quality evaluation.

Then, the obtained n times B row vector is structured in a matrix format and the median values of the elements in every row are calculated. The *n* value obtained in this way gives the percentage distribution of value factors, that is, importance values (W priority vector with $n \times 1$ dimensions).

bij = _____.....Formula 2

D. Finding the percentage importance distribution in m decision points for every factor

In this stage, the percentage of importance distribution related to every factor is determined as explained in *b* and *c*. In other words, pair-wise comparisons and matrix operations as explained in c are repeated as many times as the number of factors. However, in this time the dimensions of comparison matrices to be used in decision points for every factor will become $m \times m$. After every comparison operation, S column vectors with $m \times 1$ dimensions and showing percentage distribution of every evaluated factor to the decision points are obtained [9].

E. Reaching the result distribution in the decision points

In this stage, *n* times *S* column vectors are all brought together. Thus, a matrix with $m \times n$ dimensions is obtained. When this matrix is multiplied with the *W* priority vector the percentage distribution of decision points (alternatives) is reached.

IV. RESEARCH METHODOLOGY AND RESULTS

Education is the basic human requirement and one should take effort to choose the best Educational Institute. Selection of academic institute depends upon several attributes related to infrastructure, faculty strength, student quality, administration, research and developmental activities, training and placement and many others. However, relative priority of these factors may vary depending on variation of individual viewpoints. In this paper an attempt has been made to rank these attributes through a strategic mathematical tool based on a databank containing a number of expert opinions.

In this study AHP method has been used to determine the significant factors influencing overall quality index of an institute that would be helpful in comparing various institutes and selecting the best one for academic purposes. The main purpose of the study is to present the consistency and applicability (feasibility) of AHP in the decision process. For this reason, some of the figures related to the evaluation criteria are fictitious. The logic integrity of the model is, however, considered.

As AHP has no effect on how the criterions are chosen, or how hierarchy is created. That is the job of the decision maker or decision analyst. So the decision team has been formed which consist of authors of the paper, 10 students, 5 lecturers, 5 assistant professors and 2 director/principle of the different renowned Institution of Madhya Pradesh.

Our study investigated 24 evaluation criterions under the 6 main sections of service quality and then makes a semi fictitious chart. In this Firstly, available data's are collected from the web sites of the different considered Institutes and unavailable data are making fictitious with the help of faculty and students of considered Institute. Then with the help of decision team marked evaluation criterions out of 10 as shown in Table 2. As our data are semi fictitious so the names of the Institutes are not mention in this paper.

Table 2 : Evaluation criteria and estimations (out of 10).

Evaluation factor	Institute I	Institute II	Institute III	Institute IV	Institute V
Basic Infrastructure	4	9	6	5	3
Extra facilities regarding Infrastructure	6	10	4	4	2
Faculty Student Ratio	6	6	6	9	5
Faculty qualifications, experience & retention	8	9	5	6	4
Participation of faculty in Institutional /Departmental development	5.5	9	6	8	6.5
Faculty publications/Awards	8	8	4	7	4
Supporting staff Qualification/Skills	9	9	7	7	4
Annual budget Input	5	5	9	7	8
Annual budget utilization	9	9	6	7	2
Syllabus covered	5	5	9	9	8
Contents beyond the syllabus	6	6	9	8	4
Continuous evaluation	5	5	9	8	4
Students' feedback	4	4	10	8	5
Extra-curricular and co-curricular activities	9	8	6	7	4
Personality development initiatives	9	9	6	6	4
Professional Society activities	8	6	6	4	3

(Cont...)

Evaluation factor	Institute I	Institute II	Institute III	Institute IV	Institute V
Entrepreneurship development	5	9	5	9	3
Alumni interaction	9	9	3	5	3
Industry participation in development and student related activities	9	9	5	5	3
In-house R&D activities	8.5	9	5	4	3
Annual Planning & monitoring	9	7	5	4	3
Promotional policies/procedure	3	3	5	7	10
Leadership	7	10	6	4	3
Motivational Activities	4	5	9	7.5	4

Now the role of AHP arises the decision team firstly structured the decision hierarchy and compared the decision criteria with each other using Table 1. In the comparisons, every factor was compared with the others independently. If the predominance was used in favour of the base factor, the integer was given. If the predominance was employed in favour of the compared factors, the fraction was given. For example, the first row in Table 3 shows the comparison of the Basic Infrastructure (base factor) with the other factors. When the Basic Infrastructure is compared with the Extra facilities regarding Infrastructure, an integer of 5 was given due to using the preference in favour of the Basic Infrastructure. However, when the Extra facilities regarding Infrastructure factor was compared with the Faculty Student Ratio, 1/5 was employed because of using the preference in favour of the Faculty Student Ratio. The comparison results are presented in Table 3.

At this stage, we determined the Weighing Coefficient of the evaluation factors by using the AHP method mentioned in Section 3 and the rank them according to their Weighing Coefficient as shown in Table 4.

Table 3 : Experts' opinions on alternatives with respect to different criteria.

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**
1	1	5	2	3	7	7	9	1	1	2	5	3	3	5	7	7	9	7	7	9	3	5	5	5
2	1/5	1	1/5	1/3	1/2	2	1/2	1/7	1/7	1/7	1	1/3	1/2	1/3	1/2	2	2	3	2	5	1/5	3	1/2	1/3
3	1/2	5	1	1/2	3	3	5	1/3	1/3	1	3	3	3	3	3	5	2	3	2	7	2	5	3	3
4	1/3	3	2	1	3	5	3	1/3	1/3	1/2	3	1/2	1/2	2	3	5	7	7	5	7	1/3	3	3	2
5	1/7	2	1/3	1/3	1	3	3	1/5	1/5	1/3	3	1	2	3	3	5	5	5	5	7	1/5	3	1/3	1/2
6	1/7	1/2	1/3	1/5	1/3	1	2	1/7	1/7	1/7	1/3	1/3	1/3	1/3	1	2	2	3	3	3	1/3	1	1/3	1/3
7	1/9	2	1/5	1/3	1/3	1/2	1	1/7	1/7	1/7	3	1/3	1/3	1/3	2	3	3	3	3	3	1/3	1	1/3	1/5
8	1	7	3	3	5	7	7	1	1	3	7	3	3	5	7	7	9	9	7	9	3	5	3	3
9	1	7	3	3	5	7	7	1	1	3	7	3	3	5	7	7	9	9	7	9	3	5	3	3
10	1/2	7	1	2	3	7	7	1/3	1/3	1	7	3	3	5	5	5	7	7	7	9	3	3	2	2
11	1/5	1	1/3	1/3	1/3	3	1/3	1/7	1/7	1/7	1	1/5	1/5	1/3	1	2	3	3	5	5	1/5	1/3	1/3	1/5
12	1/3	3	1/3	2	1	3	3	1/3	1/3	1/3	5	1	1	3	3	3	5	5	5	5	1/3	3	3	1
13	1/3	2	1/3	2	1/2	3	3	1/3	1/3	1/3	5	1	1	3	3	3	5	5	5	5	1/3	3	3	1
14	1/5	3	1/3	1/2	1/3	3	3	1/5	1/5	1/5	3	1/3	1/3	1	5	5	5	5	5	7	1/5	3	1	1/3
15	1/7	2	1/3	1/3	1/3	1	1/2	1/7	1/7	1/5	1	1/3	1/3	1/5	1	3	3	3	3	3	1/5	1/3	1/3	1/5
16	1/7	1/2	1/5	1/5	1/5	1/2	1/3	1/7	1/7	1/5	1/2	1/3	1/3	1/5	1/3	1	1	1	1/3	1/3	1/5	1/3	1/3	1/5
17	1/9	1/2	1/5	1/7	1/5	1/2	1/3	1/9	1/9	1/7	1/3	1/5	1/5	1/5	1/3	1	1	1	1/3	1/3	1/5	1/3	1/3	1/5
18	1/7	1/3	1/5	1/7	1/5	1/3	1/3	1/9	1/9	1/7	1/3	1/5	1/5	1/5	1/3	1	1	1	1/3	1/3	1/5	1/3	1/3	1/5
19	1/7	1/2	1/5	1/5	1/5	1/3	1/3	1/7	1/7	1/7	1/5	1/5	1/5	1/5	1/3	3	3	3	1	5	1/3	1	1/3	1/5
20	1/9	1/5	1/7	1/7	1/7	1/3	1/3	1/9	1/9	1/9	1/5	1/5	1/5	1/7	1/3	3	3	3	1/5	1	1/5	1/3	1/3	1/5
21	1/3	5	1/2	3	5	3	3	1/3	1/3	1/3	5	3	3	5	5	5	5	5	3	5	1	5	3	1
22	1/5	1/3	1/5	1/3	1/3	1	1	1/5	1/5	1/3	3	1/3	1/3	1/3	3	3	3	3	1	3	1/5	1	1/2	1/5
23	1/5	2	1/3	1/3	3	3	3	1/3	1/3	1/2	3	1/3	1/3	1	3	3	3	3	3	3	1/3	2	1	1/3
24	1/5	3	1/3	1/2	2	3	5	1/3	1/3	1/2	5	1	1	3	5	5	5	5	5	5	1	5	3	1

Table 4: Criteria/Sub Criteria Weighing Coefficient and Rank

S. No.	Criteria	Weighing Coefficient in %	Rank
I	Physical resources	13.16775	5
II	Human resources	18.83463	3
III	Financial Resources, Allocation and Utilization	22.5706	1
IV	Teaching – learning processes	18.88699	2
V	Supplementary processes	10.04246	6
VI	Organization and Governance	16.49757	4

S. No.	Sub Criteria	Weighing Coefficient in %	Rank
1	Basic Infrastructure	11.30008	1
2	Extra facilities regarding Infrastructure	1.867667	15
3	Faculty Student Ratio	6.298545	5
4	Faculty qualifications, experience & retention	5.271578	6
5	Participation of faculty in Institutional /Departmental development	3.727957	10
6	Faculty publications/Awards	1.637268	18
7	Supporting staff Qualification / Skills	1.899279	14
8	Annual budget input	11.2853	2
9	Annual budget utilization	11.2853	2
10	Syllabus covered	8.068349	3
11	Contents beyond the syllabus	1.85775	16
12	Continuous evaluation	4.538422	8
13	Students' feedback	4.422473	9
14	Extra-curricular and co-curricular activities	3.380133	11
15	Personality development initiatives	1.702821	17
16	Professional Society activities	0.940028	21
17	Entrepreneurship development	0.810893	22
18	Alumni interaction	0.806685	23
19	Industry participation in developmental and student related activities	1.387263	19
20	In-house R&D activities	1.014635	20
21	Annual Planning & monitoring	6.479242	4
22	Promotional policies/procedure	1.936422	13
23	Leadership	3.116791	12
24	Motivational Activities	4.965117	7

The second stage of the decision hierarchy makes up the evaluation of the product models from the view of every factor separately. In the evaluation, Tables 1 and 2 are used. The results of the evaluation are shown in Table 5. In Table 5, the importance distributions of the decision points for every factor are calculated as explained in Section 3.

As pointed out above, the AHP method requires a two-stage process. The first stage is the determination of the evaluation factors affecting the decision and the calculation of the percentage distributions. The second stage is to find the percentage distributions of the decision points and to form a matrix with $m \times n$ dimensions from the percentage distributions of the decision points. In this study, the decision team reached the result distributions of the decision points by multiplying the column vector showing the percentage distribution related to the evaluation factors from the first stage, with the matrix giving the percentage distribution of the decision points according to the evaluation factors. The results are presented in Table 6.

Now we determined the importance value of the Institute-I as 19.745 percent, the Institute-II as 26.927 percent Institute -III as 21.492 percent, Institute-IV as 20.717 percent, and the Institute -V as 11.116 percent. Therefore, the Institute -II is the overall performance wise best Institute.

Paper does not investigate nor discuss some doubts related to the problem formulation or AHP postulates. For example, AHP has no effect on how the criterions are chosen, or how hierarchy is created. That is the job of the decision maker or decision analyst Here it was done by the decision team which consist of authors of the paper, 10 students, 5 lecturers, 5 assistant professors and 2 director/principle of the different renowned Institutes of Madhya Pradesh. AHP achieves satisfactory consistency if basic rules of utility theory are applied. It was here fully provided and results may be accepted as trustworthy.

Table 5 : The evaluation of the colleges.

1. Basic infrastructure

	I	II	III	IV	V	% Weight
I	-	1/5	1/3	1	3	11.4735
II	5	-	5	5	5	51.07427
III	3	1/5	-	2	2	17.10182
IV	1	1/5	1/2	-	2	13.63292
V	1/3	1/5	1/2	1/2	-	6.717493

2. Extra facilities regarding infrastructure

	I	II	III	IV	V	% Weight
I	-	1/5	3	3	3	18.25
II	5	-	7	7	9	58.9882
III	1/3	1/7	-	1	3	9.142135
IV	1/3	1/7	1	-	3	9.142135
V	1/3	1/9	1/3	1/3	-	4.477527

3. Faculty student ratios

	I	II	III	IV	V	% Weight
I	-	1	1/3	1/3	3	14.25598
II	1	-	1	1/3	3	16.36135
III	3	1	-	1/3	1	18.08445
IV	3	3	3	-	5	42.93113
V	1/3	1/3	1	1/5	-	8.367092

4. Faculty qualifications, experience and retention

	I	II	III	IV	V	% Weight
I	-	½	5	5	7	30.33741
II	2	-	7	7	9	48.27345
III	1/5	1/7	-	1/3	2	6.058886
IV	1/5	1/7	3	-	4	11.20391
V	1/5	1/9	1/2	1/4	-	4.126344

5. Participation of faculty in institutional/departmental

	I	II	III	IV	V	% Weight
I	-	1	1/3	1/3	½	11.96433
II	1	-	3	3	3	34.59572
III	3	1/3	-	1/3	½	12.94817
IV	3	1/3	3	-	3	26.15075
V	2	1/3	2	1/3	-	14.34103

6. Faculty publications/awards

	I	II	III	IV	V	% Weight
I	-	1	3	3	5	33.90118
II	1	-	3	3	5	33.90118
III	1/3	1/3	-	1/3	1	8.671807
IV	1/3	1/3	3	-	3	16.71407
V	1/5	1/5	1	1/3	-	6.811764

7. Supporting staff qualification/skills

	I	II	III	IV	V	% Weight
I	-	1	3	3	5	34.23622
II	1	-	3	3	5	34.23622
III	1/3	1/3	-	1	3	12.98024
IV	1/3	1/3	1	-	3	12.98024
V	1/5	1/5	1/3	1/3	-	5.56708

8. Annual budget

	I	II	III	IV	V	% Weight
I	-	1	1/3	1/3	1/3	8.987943
II	1	-	1/3	1/3	1/3	8.987943
III	3	3	-	2	1	31.25121
IV	3	3	1/2	-	1	23.80747
V	3	3	1	1	-	26.96543

9. Annual budget utilization

	I	II	III	IV	V	% Weight
I	-	1	3	2	7	32.23601
II	1	-	3	2	7	32.23601
III	1/3	1/3	-	1/2	5	12.12947
IV	1/2	1/2	2	-	7	19.79756
V	1/7	1/7	1/5	1/7	-	3.600945

10. Syllabus covered

	I	II	III	IV	V	% Weight
I	-	1	1/3	1/3	3	10.655
II	1	-	1/3	1/3	3	10.655
III	3	3	-	1	5	27.25982
IV	3	3	1	-	5	27.25982
V	1/3	1/3	1/5	1/5	-	24.17036

11. Contents beyond the syllabus

	I	II	III	IV	V	% Weight
I	-	1	1/3	1/3	3	12.87013
II	1	-	1/3	1/3	3	12.87013
III	3	3	-	2	5	39.07836
IV	3	3	1/2	-	5	29.68038
V	1/3	1/3	1/5	1/5	-	5.501006

12. Continuous evaluations

	I	II	III	IV	V	% Weight
I	-	1	1/3	1/3	1	10.54443
II	1	-	1/3	1/3	2	11.973
III	3	3	-	2	5	39.6643
IV	3	3	1/2	-	5	30.26632
V	1	1/2	1/5	1/5	-	7.551953

13. Students' feedback development

	I	II	III	IV	V	% Weight
I	-	1	1/4	1/3	½	8.135259
II	1	-	1/4	1/3	½	8.135259
III	4	4	-	5	7	51.35109
IV	3	3	1/5	-	3	20.93688
V	2	2	1/7	1/3	-	11.44151

14. Extra-curricular and co-curricular activities

	I	II	III	IV	V	% Weight
I	-	2	3	3	5	39.24142
II	1/2	-	3	2	5	27.09427
III	1/3	1/3	-	1/2	3	11.42712
IV	1/3	1/2	2	-	4	16.9892
V	1/5	1/5	1/3	¼	-	5.248001

15. Personality development initiatives

	I	II	III	IV	V	% Weight
I	-	1	3	3	5	34.23622
II	1	-	3	3	5	34.23622
III	1/3	1/3	-	1	3	12.98024
IV	1/3	1/3	1	-	3	12.98024
V	1/5	1/5	1/3	1/3	-	5.56708

16. Professional society activities initiatives

	I	II	III	IV	V	% Weight
I	-	1	2	3	5	33.2003
II	1	-	1	2	3	24.18324
III	1/2	1	-	3	5	25.49176
IV	1/3	1/2	1/3	-	2	10.88204
V	1/5	1/3	1/5	1/2	-	6.242658

17. Entrepreneurship developments

	I	II	III	IV	V	% Weight
I	-	1/3	1	1/3	3	12.65607
II	3	-	3	1	7	35.86434
III	1	1/3	-	1/3	3	12.65607
IV	3	1	3	-	5	33.75908
V	1/3	1/7	1/3	1/5	-	5.064446

18. Alumni interaction

	I	II	III	IV	V	% Weight
I	-	1	5	5	7	37.65908
II	1	-	5	5	7	37.65908
III	1/5	1/5	-	1/3	½	5.497637
IV	1/5	1/5	3	-	5	13.83472
V	1/3	1/7	1/3	1/5	-	5.349484

19. Industry participation in development and student related activities

	I	II	III	IV	V	% Weight
I	-	1	3	5	7	36.17195
II	1	-	3	5	7	36.17195
III	1/3	1/3	-	3	5	16.32014
IV	1/5	1/5	1/3	-	2	7.071788
V	1/7	1/7	1/5	1/2	-	4.264171

20. In-house R and D activities

	I	II	III	IV	V	% Weight
I	-	1	3	3	5	33.26639
II	1	-	3	3	7	35.26639
III	1/3	1/3	-	2	4	15.56453
IV	1/3	1/3	1/2	-	3	11.13134
V	1/5	1/7	1/4	1/3	-	4.771347

21. Annual planning and monitoring

	I	II	III	IV	V	% Weight
I	-	2	3	4	5	41.32774
II	1/2	-	2	3	4	25.93778
III	1/3	1/2	-	2	3	15.91628
IV	1/4	1/3	1/2	-	3	10.97123
V	1/5	1/4	1/3	1/3	-	5.846966

22. Promotional policies/procedure

	I	II	III	IV	V	% Weight
I	-	1	1/2	1/5	1/7	5.858679
II	1	-	1/3	1/5	1/7	5.519627
III	2	3	-	1/3	1/5	11.67077
IV	5	5	3	-	1/3	26.1243
V	7	7	5	3	-	50.82662

23. Leadership

	I	II	III	IV	V	% Weight
I	-	1/3	2	3	5	20.52855
II	3	-	5	7	9	51.23463
III	1/5	1/2	-	3	5	16.0012
IV	1/7	1/3	1/3	-	3	8.243157
V	1/9	1/5	1/5	1/3	-	3.992465

24. Motivational activities

	I	II	III	IV	V	% Weight
I	-	1/2	1/3	1/3	1	9.511803
II	2	-	1/3	1/2	2	15.40721
III	3	3	-	2	5	40.95586
IV	3	2	1/2	-	3	25.73983
V	1	1/2	1/5	1/3	-	8.385292

Table 6 : Result distributions of decision points.

$$\begin{bmatrix} 0.012965 & 0.003408 & 0.008979 & 0.015993 & 0.00446 & 0.005551 & 0.006502 & 0.010143 & 0.036379 & 0.008597 & 0.002391 & 0.004786 \\ 0.057714 & 0.011017 & 0.010305 & 0.025448 & 0.012897 & 0.005551 & 0.006502 & 0.010143 & 0.036379 & 0.008597 & 0.002391 & 0.005434 \\ 0.019325 & 0.001707 & 0.011391 & 0.003194 & 0.004827 & 0.00142 & 0.002465 & 0.035268 & 0.013688 & 0.021994 & 0.00726 & 0.018001 \\ 0.015405 & 0.001707 & 0.02704 & 0.005906 & 0.009749 & 0.002737 & 0.002465 & 0.026867 & 0.022342 & 0.021994 & 0.005514 & 0.013736 \\ 0.007591 & 0.000836 & 0.00527 & 0.002175 & 0.005346 & 0.001115 & 0.001057 & 0.030431 & 0.004064 & 0.019501 & 0.001022 & 0.003427 \end{bmatrix} \times \begin{bmatrix} 0.113000821 \\ 0.018676668 \\ 0.062985451 \\ 0.052715779 \\ 0.037279574 \\ 0.016372679 \\ 0.018992787 \\ 0.112852991 \\ 0.112852991 \\ 0.080683491 \\ 0.018577505 \\ 0.045384217 \\ 0.044224731 \\ 0.033801335 \\ 0.017028214 \\ 0.009400284 \\ 0.008108933 \\ 0.008066846 \\ 0.013872628 \\ 0.01014635 \\ 0.064792423 \\ 0.019364219 \\ 0.031167913 \\ 0.049651171 \end{bmatrix} = \begin{bmatrix} 0.19745 \\ 0.26927 \\ 0.21492 \\ 0.20717 \\ 0.11116 \end{bmatrix}$$

$$\begin{bmatrix} 0.003598 & 0.013264 & 0.00583 & 0.003121 & 0.001026 & 0.003038 & 0.005018 & 0.003375 & 0.026777 & 0.001134 & 0.006398 & 0.004723 \\ 0.003598 & 0.009158 & 0.00583 & 0.002273 & 0.002908 & 0.003038 & 0.005018 & 0.003578 & 0.016806 & 0.001069 & 0.015969 & 0.00765 \\ 0.02271 & 0.003863 & 0.00221 & 0.002396 & 0.001026 & 0.000443 & 0.002264 & 0.001579 & 0.010313 & 0.00226 & 0.004987 & 0.020335 \\ 0.009259 & 0.005743 & 0.00221 & 0.001023 & 0.002738 & 0.001116 & 0.000981 & 0.001129 & 0.007109 & 0.005059 & 0.002569 & 0.01278 \\ 0.00506 & 0.001774 & 0.00095 & 0.000587 & 0.000411 & 0.000432 & 0.000592 & 0.000484 & 0.003788 & 0.009842 & 0.001244 & 0.004163 \end{bmatrix}$$

V. CONCLUSION

This Paper has illustrated the application of an Analytic Hierarchy Process (AHP) methodology in the evaluation of Technical Institutes of Madhya Pradesh. A Pair-wise comparison method was used to calculate the weight for each criterion based on semi fictitious data gather from the five Technical Institutes of the Madhya Pradesh. Available pertinent literature and authors' knowledge indicate that this is probably the first AHP application in Technical Institutes evaluation. At least, it demonstrates ease in providing full and creative cooperation of Technical expert and specialists in the field of system analysis and mathematical techniques for multiple-criterion, computer supported, decision making. There is a strong motivation to continue research in this field, and certain results are expected to be published soon.

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