

PERFORMANCE EVALUATION OF TECHNICAL EDUCATION INSTITUTE AS A SYSTEM FOR TOTAL QUALITY

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ABSTRACT

The present system of Evaluation for an Engineering Institute in India is done as per the procedure mentioned in National Board of Accreditation manual as prescribed by All India Council for Technical Education (AICTE) for review of entire Institution as well as for review of Individual program. With the advent of modern communication systems, new economic policies and globalisation, Internet, Networking of Universities etc. the Institutes have to be more responsive and quality conscious. In this paper, some methods have been suggested so as to quantitatively assess the quality of education in Technical Institutions of all types, which will help to enhance the accountability of performance evaluation system with the help of input-output factors and performance indicators.

1.0 Introduction :

Performance evaluation is a process of quality assurance, whereby an approved institution or programme is critically appraised at regular intervals so as to confirm whether an institution or a programme meets the norms and standards prescribed by the Council from time to time. This Performance Evaluation term is of utmost importance in today's scenario wherein Internet, Networking of Universities, Globalisation, the craze of bright and promising students to go abroad for post graduation etc. is taking deeper roots in our country. The advent of modern communication system emphasises on the fact that the Institutes have to be more responsive, offer a better Engineer and keep moving ahead on the path of excellence. In short, we can say this is what the Total Quality Management and ISO 9000 series are doing today in manufacturing organisations to achieve world class business and competitiveness.

TQM is an approach to management

that focus on customer expectation, preventing problems, building commitment to quality in the work force and promoting open decision making. Where as ISO 9000 series of standards is a definition for a quality management system wherein all the key procedures have been written down and understood. Thus Quality Assurance as described in Accreditation Manual can lead to TQM in any institute. Taylor (1990) comments that there is an urgent need for engineering education to practise what they preach and move towards a customer - centred, market-centred, market-driven education system dedicated to continuous self improvement.

Now to measure the continuous improvement or customer - centred education system, NBA (National Board of Accreditation) has clearly mentioned in the manual of Evaluation procedure the questionnaire for review of Entire Institution as well as for review of Individual programme. However, in this paper, methods have been suggested so as

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to objectively assess the quality of education in Technical Institution, which will help to enhance the accountability of performance evaluation system.

Facilities for technical education in India, in general, and in state of Maharashtra, in particular, are growing very fast. This growth is mainly due to change in government policy and willingness from professional institutes to impart technical education on self finance basis (i.e. no-grant basis). Naturally, this has given rise to deep concern regarding standard of education imparted in these institutes.

As Engineer passing out from these institutes is required to fulfil modern and high-standard requirements needed by industry, government, business houses and other sectors from society. An institute which has "Quality Conscious mind and continuous Quality management" as a way of life can only produce "Quality Engineer" who will meet the present time requirements and will be the most suitable engineer for tomorrow. Today's slogan is "Survival of the Qualities." For this, continuous performance appraisal of these institutes is needed.

2.0 Present Efforts :

Presently, bodies responsible for technical education have already started assessment of Engineering and Technological institutes. Government of Maharashtra has given grades to different institutes. A.I.C.T.E. has set up an evaluation procedure for Accreditation. Their systems of performance appraisal are elaborate, still it is felt that there is a need for quantifiable indicators to evaluate the performance. In this article an attempt has been made to :-

1) Analyse "Technical Education" as system,

2) To suggest quantifiable indicators to evaluate performance of institutes and

3) to find the performance efficiency factor of technical education system.

3.0 Technical Education As A System :

Refer fig. 1.0 (Page No. 126)

a) System Inputs :

- i) Government, All India Council for Technical Education and Director for Technical Education and Universities are mainly responsible for framing rules regarding minimum requirements of land, physical facilities, staff, books etc. They appoint inspection committees and verify actuals. They have a right to withdraw the approval given to such defaulter institutes. They also fix pay-scales, service rules for staff to be employed in these institutes.
- ii) In addition, University is mainly responsible for framing rules for academic part. They frame course duration, number of subjects to be taught, semester or year-wise examination pattern etc. Different Universities have their own rules, and they differ from other Universities; however, more or less, they are similar.
- iii) Students are admitted to these institutes by the government on merit as well as payment basis. (All students have to satisfy the criteria of scoring minimum 50% marks but payment seat students have to pay heavy fees; so such students generally score marks much less than merit seat students.) Thus there is a lot of variation in the marks obtained by the students who take admission to the institute because of fee-structure and seat reservation. This has an

effect on teaching learning process.

- iv) Education society or private bodies which take up the responsibility of running such technical institutes are mainly responsible for providing physical facilities, teaching staff, equipment, other supporting staff etc. to run the technical education institute. This, they provide not because it is forced on them by the government but because of their own quality conscious mind and reputation in the society.

This factor can also be called as External input factor.

b) System Process :

System process includes teaching-learning activity conducted in classrooms, in practical periods, site visits and by way of self-study in the form of project work. Their performance can be judged by the term "process" which is a key component in the system. It's success or failure will decide the fate and future of the system. "Teacher-student" are "Brain-Heart" of the process and therefore their role in continuous "Quality" management and improvement is important. System process can also be considered as internal input to the system.

c) System Output :

System output is the students passing out from the technical institute as an Engineer. How they are accepted by the government, industries, business houses will tell about their quality. They should be taught the significance of the concept of Quality and Quality awareness in present day engineering field. This will help them to survive in the competitive market for their own benefit as well as for the organisation for whom they are

working. The output which we get from the system can be either expected output or actual output which will depend on the efficiency of the system.

d) Feed Back :

Feed back in a system is an effective tool for improvement in the system. As such "Sky is the limit" for "Quality" product and this can be achieved only by impartial, alert and efficient feed back system. This is actually "Quality Improvement" input in a system. Depending on the Performance Efficiency Factor, the feed back to the system will suggest the corrective measures to be taken to improve the efficiency of the system. For quality management in technical institute we must first examine our self. What are our short comings? What are our strengths? What developments we need to do to improve the total quality in our institute? Etc. All these questions need proper assessment of the institute to get true answers. Present systems of institute assessment are grading them as A, B,etc. as per their performance evaluation. For this, performance indicators are suggested here to be used which will indicate the efficiency of the institute. This method can be further improved if "Quantifiable" input, output factors are found out and their ratio output/input is marked as performance factor for the institute. Such performance factors can give true picture of the institute and it will also indicate exactly where the improvement is required in the system.

4.0 Input Factor :

This Input factor can be subdivided

into External Input and Internal Input. External input is considered to be based on the infrastructure facilities and the merit of the student admitted whereas Internal input will include the system process factors such as Teaching ability, faculty's academic qualifications - student development programmes etc. Let's discuss each input factor.

4.1 External Input Factor :

a) Control Factor (C.F.) :

In India, Government of Maharashtra and Director of Technical Education have suggested a good marking system for

institutional grading. In that list they have given maximum marks for each item and their sum total to hundred. Marks obtained by each institute is graded accordingly. Here it is suggested that the following items should only be considered i.e.

i) Land and Building ii) Laboratory and equipment iii) Library iv) Teaching faculty v) Computer and vi) Other facilities.

The marks have been assigned based on the amount of money invested or number of items available. Instead of

taking the sum of marks obtained in each item the ratio or marks obtained/maximum marks should be taken (calculation shown in annexure (1))

b) Students Entry Factor :

This is to be calculated on marks obtained by each students in Physics, Chemistry and Mathematics and finding out its average. This will be calculated as

$$\text{Average Marks} = \frac{\sum \text{Total P.C.M. Mark obtained by all admitted student in first year}}{\text{Total No. of Students admitted}}$$

$$\text{S.E.F.} = \frac{\text{Average Marks}}{\text{Sum of maximum marks in P.C.M.}}$$

And now we can calculate the Internal Input factor for particular institute by taking the average of C.F. and S.E.F. i.e.

$$\text{External Input Factor} = \frac{\text{C.F.} + \text{S.E.F.}}{2}$$

4.2 Internal Input Factor :

Table 1.0

S.No.	Factor for assessing the quality of teacher	Suggested method for evaluating the factor
a)	Qualification	e.g. If B.E. - 6 marks If M.E. - 8 marks If PhD - 10 marks
b)	No. of subjects taught (versatility)	e.g. Min 4 sub. in last three years = 5 marks More than 6 sub in three years = 10 marks

c)	No. of books refereed	e.g. Min 10 books refereed in last three years (can be found from library card or list of personal books) = 5 marks More than 20 books refereed in last three years = 10 marks
d)	No. of seminars attended	e.g. Min. 2 attended last one year = 5 marks More than 4 attended in last one year = 10 marks
e)	No. of papers published or presented	e.g. Min 1 published in an year = 5 marks More than 3 published in an year = 10 marks
f)	Worked as faculty for advance course/college development work	e.g. Min 1 course in an year = 5 marks More than 2 Courses in an year = 10 marks
g)	Published books	e.g. Min 1 book in last 5 years = 5 marks More than 2 books in last five years = 10 marks
h)	Average of the Performance appraisal marks by head of the department for last three yers.	e.g. $6+8+8/3=7.33$ i.e. (marks for each year) / (3)
i)	Teaching ability (in the form of grade) feedback from the students for last two years.	e.g. If A1=10 marks A = 8 marks B1= 6 marks B = 5 marks C = 3 marks
j)	Participation in student development program.	No. of programs conducted for students e.g. Extra curricular activities, college magazine, N.C.C., N.S.S., personality development program, entrepreneurship development, small team work activities like quality circles, sports, counselling etc. Min 1 program in last one year = 5 marks More than 2 programs in last one year = 10 marks.

In assessing the overall competence of the faculty of an Institution, the factors taken into account are

1. Faculty : Quality of Teacher Factor :

The quality of a teacher depends on a number of factors. An attempt is made to list the important factors which help in making a quality teacher and quantify it. (Ten marks scale can be used)

These marks can be calculated out of 100 and quality of teacher factor Total of all the marks from (a) to (j) to be added up in case marks are to be given between min & max suggested range, the marks can be interpolated. The total marks can be calculated for an individual teacher and the quality of teacher factor can be found. Similarly the Fqtf for each teacher to be added up and divided by the no of teacher will give the factor for the Institute (calculations shown in annexure (1)).

2. Teaching Effectiveness Factor :

Its very difficult to measure teaching effectiveness cause the results of students in examination depends on student's efforts, teacher's efforts, the college atmosphere, the paper evaluation system and other factors. Individual teacher's performance can be measured by taking into account their results in the number of subjects taught i.e.

For an individual teacher

Subject Taught	% Result (passing)
Sub. 1	y_1
Sub. 2	y_2
Sub. n	y_n
Cumulative Total %	Σy

$$\text{Teacher}_{\text{tef}} \frac{\Sigma y}{n} = T_{\text{tef}}$$

Similarly, Teachers T_{TEF} for each teacher can be calculated and the cumulative Teaching Effectiveness factor for each Department & thus for the college can be calculated by

$$T_{\text{TEFC}} = \frac{T_{\text{tef1}} + T_{\text{tef2}} + \dots + T_{\text{tefn}}}{N_n}$$

This factor can help in performance evaluation of the Institute. Though the individual teachers teaching effectiveness factor will also depend on the nature of subject taught e.g. Theoretical subject, problem based subjects, design subjects etc. Thus T_{ef} for individual teacher can be compared with similar subject in other institutes although the cumulative Teaching effort factor (T_{tefc}) will take into account all such subjects in each institute (calculations shown in annexure (1)).

3. Utilisation factor for laboratories, library books and computer facility :

Laboratories, Library and Computer facility associated with the programme, are evaluated in terms of cost of equipments, number of books, number of computer units respectively. Along with cost, utilisation factor should also be taken in account to assess the actual use of invested financial resources e.g. For library utilisation factor

$$U_{\text{t...}} = \frac{\text{No. of books issued (with different Acc. No.) during one year}}{\text{Total No. of books}}$$

Similarly for Technical journals/ Magazines etc. the U_{f} can be calculated

* FOR LABORATORIES :

E_{qml} used for practical related with the course

(a) Let the equipment utilisation factor be U_{eqml}

$$U_{eqml} = \frac{nL \times \text{No. of practicals conducted in a particular lab / year}}{\text{Amount Invested in Eqmt}}$$

When n_t is a factor which indicates Relative cost of performing the experiment using the E_{qmt} if taken on rent.

(b) Let the utilisation factor for research and consultancy be $U_{r\&c}$

$$U_{r\&c} = \frac{\text{Amount of Rs. earned in R \& Consult work / year}}{\text{Amount Invested in Eqmt}}$$

*** Computer Facility :**

$$U_{compf} = \frac{\text{Total No. of hrs. computers used / year}}{\text{Total No. of computer hours available / Annual}}$$

This ratio can be used for each department separately. Such ratio's will give more realistic picture and can be used for comparison and accreditation of colleges. (calculations shown in annexure (1).

4. Student development program factor

All round development of students require involvement of the students & college staff in co-curricular and extra curricular activities.

Suggested method to measure the student's performance can be as follows :

(5 point scale can be used for each activity)

a) Quality of college magazine :

It can be measured in terms of prize's won in Inter college, inter university magazine competition etc. In case prizes are won, it can be given certain credits e.g.

Prize won	Points
1st Prize	5
2nd Prize	3
3rd Prize	2
Special Prize (for taking part in competition)	1

Total points can be added up for the college depending upon the prize won.

b) Sports :

- i) No. of awards / Trophies offered by college for various sports competition. (Relative points can be given based on a No. of awards / Trophies and sports competition held.)
- ii) Participation in Inter college sports competition and No. of prizes won at State level / National level etc. (Relative points can be given based on Participation and prizes won as shown for (1) above).

c) Extra Curricular Activities :

Various Inter college competition like Quiz, Debates, Personality contest, Dance, Dramatics, Technical Paper presentation competition etc. (Relative points can be given as suggested above). Student development factor can be calculated by adding up the points scored in the item 1, 2 and 3 above divided by actual total points allocated. (calculations shown in annexure (1).

5.0 Output Factor :

a) Result Factor :

"Result factor" this can be adopted with slight modification as suggested by Dr. K. B. Powar and Dr. B. P. Sable (1995). They have put forward the idea of performance indicator in higher education which is borrowed from economics when the efficiency of a system or institution is related with its productivity in terms of efficiency and return. They may, therefore, broadly be described as quantifiable variables that may be used as tools in decision making. They are to be used to measure the accountability of an academic Institution.

$$M.D.S. = \frac{75xD + 60xI + 50xII + 40xIII}{T}$$

Where D Number of students passing with distinction.

I Number of students in first class.

II Number of students in second class.

III Number of students in pass class.

T Total number of students graduate.

Here the weightages 75, 60, 50, and 40 correspond to the minimum number of percentages necessary for securing distinction, I, II, and III class in most Indian universities.

$$\text{Result factor (R.F.)} = \frac{M.D.S.}{100}$$

6.0 Performance Efficiency Factor For An Institute :

$$\text{Performance Efficiency Factor} = \frac{\text{Output factor}}{\text{Input factor}} \rightarrow (\text{Eqn No. (1)})$$

Where

$$\text{Input factor} = \frac{\text{Internal input factor} + \text{External input factor}}{2} \rightarrow (\text{Eqn. No. (ii)})$$

b) Students Acceptance Factor :

This will indicate how many students are accepted by industry and other institutes after they graduate from a particular institute. This factor has direct effect of "Demand and Supply" theory and as such institute has little control over it. Hence only 20% weightage is given to this factor and 80% to R.F.

Hence

$$S.A.F. = \frac{\text{Total number of students - placed in one year's time}}{\text{Total number of students graduated}}$$

Therefore output factor can be calculated as :-

$$O.F. = 0.8 \times \text{result factor} + 0.2 \times S.A.F.$$

(calculations shown in annexure (1).

As shown in Educational Institute as a system, the Output can be Actual output and Expected output. Actual output is the result of actually given input i.e. Internal input and external input of the system. Expected output is considering that the input to the system has 100% efficiency and thus there is no error in the system. With knowledge of input (Internal input and external input factors) and output factors for actual & expected output we can find out "Performance Efficiency Factor" for any engineering and technical institute. This also can be called as "Process Efficiency Factor".

$$\text{Output factor} = [0.8 \times \text{R.F.} + 0.2 \times \text{S.A.F.}] \rightarrow (\text{Eqn. No. (iii)})$$

$$\text{Internal input factor} = \frac{[Eqtf + ITtef + (Uf(\text{lib, lab, comp}) / 3) + Sdevf]}{4} \rightarrow (\text{Eqn. No. (iv)})$$

$$\text{External input factor} = \frac{CF + S.E.F.}{2} \rightarrow (\text{Eqn. No. (v)})$$

Substituting in the equation no (i) we can find the performance efficiency factor for a particular Institute. We can say that performance factor will help to know the exact "Technical Institute Performance" level. Other factors which can be derived to study other parameters of the education system can be as follows :

$$\text{System efficiency} = \frac{\text{Actual output}}{\text{Expected output}} \rightarrow (\text{Eqn. No. (vi)})$$

If actual output is equal to the expected output, it indicates that the efficiency of the system is 100% and there is no error in the system. Now the P.E.F. which is found in Eqn No. (i) indicates that unless an attempt is made to improve the Input to the system, output of the system will not match the required high standards of quality in the global market. If P.E.F. is to be high then the output should be higher quality for which in turn the input should also be excellent. If the System efficiency is less than 100% Eqn No. (vi) it indicates that actual output is less than Expected output and thus there is an error in the system which can be removed by improvement in the Input to the system. This can be represented as :

$$\text{Overall improvement factor} \left(\frac{1}{\text{syst}\eta} \right) =$$

$$\frac{(\text{External input} + \text{Internal input}) / 2}{\text{Actual output}} \rightarrow (\text{Eqn. No. (vii)})$$

7.0 Conclusion :

In conclusion, we can say that Performance indicators will help us to know the exact "Technical Institutes Performance" level. Present Evaluation Procedure of NBA covers most of the important aspects required for the quality assurance of the Institution in Technical Education, however no where Quantitative methods have been suggested. Thus through this paper, an attempt is made to quantify so that the process of performance evaluation of colleges will be made easier with a strong base along with the judgement method. Instead of giving grades as A, B & C etc. the colleges can be given improvement plan for next five years which will be time bound and expenditure bound along with comparative statement of the performance factors of the other colleges grade-wise or University-wise. These remarks will be more encouraging & helpful in proper development of the Institute. In order to maintain the Quality achieved, periodic audit for quality must be carried out every year internally as well as externally by other appropriate institutes (may be other engineering Institutes) so that the quality improvement will gradually lead towards

excellence. The approach to achieve total quality should be system based so that the system elements can be modified as per requirements for excellence with new policies and management techniques practised in today's competitive Educational field.

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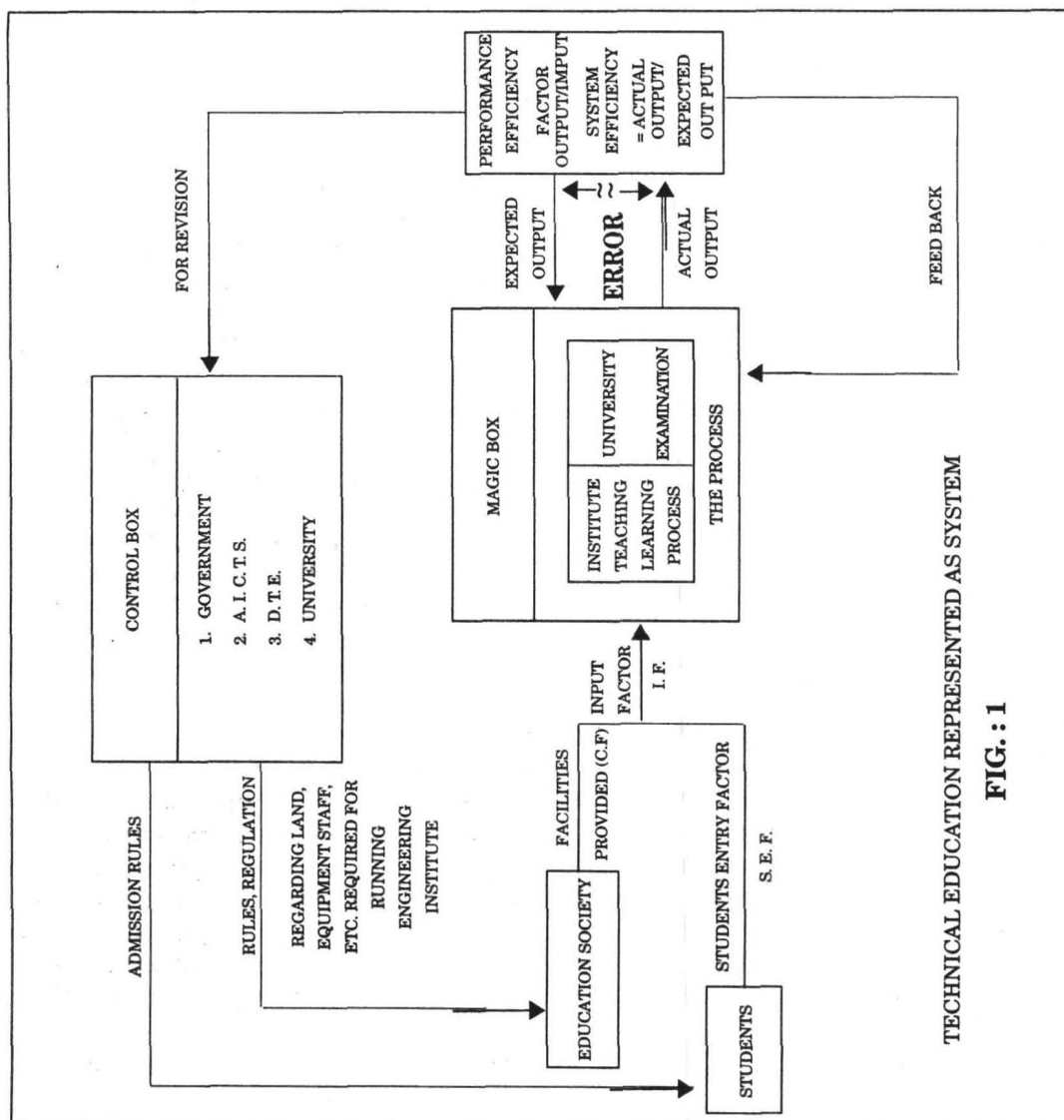


FIG.: 1

Annexure - 1**Sample Calculations For Finding The Performance Efficiency Factor :**

As explained in the paper, the total input and output to the system has to be calculated to find the P.E.F. of the technical education system. Calculations have been shown in the tabular form for an Institute to show how the factor can be worked out.

1) Total Input To The System i.e. Internal Input & External Input :**a) External Input (refer 4.1 (a))**

Sr. No.	Item	Marks obtained	Max. Marks	Ratio
1	Land and Buildings	10	15	0.67
2	Laboratory and Equipment	10	15	0.67
3	Library	08	10	0.80
4	Teaching Staff	20	25	0.80
5	Computer	09	10	0.90
6	Other facilities	08	10	0.80
	Total	65	85	0.76 Control Factor

As per norms mentioned in the N.B.A. or A.I.C.T.E. the control factor can be found :

For example "X" institution has obtained the following marks (as per norms specified for weightage for subsequent categorisation of Institutions in class A to E by A.I.C.T.E.)

Similarly 4.1 (b) Student entry factor can be found as :

S.E.F. Average of P.C.M. marks of all the students admitted to first year / max P.C.M. marks.

e.g. S.E.F. = $73.75 / 95 = 0.776$ where P.C.M. is marks scored in physics, chemistry, maths

Therefore the Ext input factor is = $0.7 + 0.776/2 = 0.74$

b) Internal input factor, refer paper topic 4.2 (1) to (4)

1) Fqtf can be evaluated for an individual teacher as discussed in topic no mentioned 4.2 (1) Table no. 1.0 (Ten marks scale can be used)

Table 1.0

S.No.	Factor for quality of teacher	Suggested method for evaluating the factor	Sample shown for evaluating the factor for a faculty member
a)	Qualification	e.g. If B.E. - 5 marks If M.E. - 8 marks If PhD - 10 marks	e.g. If B.E. - 5 marks
b)	No. of subject taught (versatility)	e.g. Min 4 sub. in last three years = 5 marks More than 6 sub in last three years = 10 marks	4 subjects taught 5 marks
c)	No. of books referred	e.g. Min 10 books referred in last three years (can be found from library card or list of personal books) - 5 marks More than 20 books referred in last three years = 10 marks	e.g. More than 20 books referred in last three years = 10 marks

d)	No. of seminars attended	e.g. Min 2 attended in last one year = 5 marks More than 4 attended in last one year = 10 marks	e.g. More than 4 attended in last one year = 10 marks
e)	No. of papers published or presented	e.g. Min 1 published in an year = 5 marks More than 3 published in an year = 10 marks	e.g. 3 published in an year = 7 marks
f)	Worked as faculty for advance course/college development work	e.g. Min 1 course in an year = 5 marks More than 2 Courses in an year = 10 marks	e.g. More than 2 Courses in an year = 10 marks
g)	Published books	e.g. Min 1 book in last 5 years = 5 marks More than 2 books in last 5 years = 10 marks	e.g. More than 2 books in last 5 years = 10 marks
h)	Average of the Performance appraisal marks by head of the department for last three years.	e.g. 6/8/8/3 - 7.33 i.e. (marks for each year/(3))	e.g. appraisal marks are as follows (7+8+3) 3 = 8
i)	Teaching ability (in the form of grade) feedback from the students for last two years.	e.g. If A + = 10 marks A = 8 marks B + = 6 marks B = 5 marks C = 3 marks	e.g. If A + = 10 marks
j)	Participation in student development program	No of programs conducted for students e.g. Extra curricular activities, college magazine, N.C.C., N.S.S., personality development programmes, entrepreneurship development, small team work activities like quality circles, sports, counselling etc. Min 1 program in last one year = 5 marks More than 2 programs in last one year = 10 marks	No of programs conducted for students e.g. one program 5 marks

For an individual teacher if the performance is evaluated as per criteria indicated in the table 1.0

e.g. it is $80/100 = 0.8$

Similarly it can be worked out for all the faculty members of an institute

If $q_{tf} = 0.70$ (say F_{qtf} min is 50 and F_{qtf} max is 90 score points then $Av = 140/2 = 70/100 - 0.70$)

2) I_{tef} can be evaluated, refer item no. 4.2 (2)

e.g. Sub	Result
Sub (1)	90%
Sub (2)	75%
Sub (3)	80%
Total	$245/3 = 81.6\%$

say T_{ef} min is 50% and T_{ef} max is 98% then $I_{tef} = 50 + 98/2 = 74\%$

This for an individual teacher, similarly it can be done for all the staff members

3) Utilization factor for Lib, Lab, Computer lab can be calculated, refer item no. 4.2 (3)

U_{lib} e.g. if no. of books available are 20,000 and issued as per accession no are 12,000

$U_{lib} = 12000/20000 = 0.6$

Similarly e.g. $U_{lab} = (0.75+0.8) / 2 = 0.78$

Similarly e.g. $U_{com} = 0.9$

Total of U_f (lib, lab, comp) = $(0.6+0.78+0.9)/3 = 0.76$

4) Student development factor (S_{devf}), refer 4.2 (4) (5 point scale is used)

a) college mag. if special prize for taking part is (i) point, therefore $1/5 = 0.2$

b) Sports - awards, trophies offered by the college per year.

e.g. awards / trophies	Points assigned
0-5	5
5-10	8
> 10	10

say for an institute it is between (0-5) therefore the points scored by an institute will be $5/10=0.5$

c) Prizes won in the competition e.g. taken part in 5 competitions and prizes won are as follows

e.g. prize won	points assigned
3rd prize	2
1st prize	5
no prize	
(only participation)	1
3rd prize	2
2nd prize	3
Total	13

Therefore the factor is = total points scored / total points assigned = $13/25 = 0.55$

d) Extra curricular activities (to be evaluated as in (c) above)

e.g. the factor is 0.43

Therefore total $S_{devf} = (0.2+0.50+0.54+0.43) / (4) = 0.42$

INTERNAL INPUT FACTOR =

$(6.7+0.78+0.76+0.42) / (5) = 0.676$

TOTAL INPUT FACTOR =

$(0.74+0.676) / (2) = 0.708$

2) Output Factor :

a) Result factor (refer item no. 6.0 (a&b))

Result factor = $M.D.S. / 100$

e.g. D = 110 students

1st class = 108

2nd class = 12

3rd class = no students

total appeared = 240

$M.D.A. = (75 \times 110) + (60 \times 108) + (50 \times 22) / (240) = 66$

$R.F. = 66 / 100 = 0.66$

b) Students acceptance factor

e.g. Let the Total number of students passed = 240

let the total students employed within an year is = 195

therefore S.A.F. = $195 / 240 = 0.81$

Total output factor = $0.66 \times 0.8 + 0.2 \times 0.81 = 0.674$

TOTAL OUTPUT FACTOR = 0.674

ACTUAL OUTPUT = 0.674

EXPECTED OUTPUT = 100% = 1

1) P.E.F. = $0.674 / 0.708 = 95\%$

2) SYSTEM N = $0.674 / 1 = 67.4\%$

3) O.I.F. = INPUT/ACTUAL OUTPUT = $0.708 / 0.674 = 1.09$

CALCULATIONS IN TABULAR FORM (TABLE NO. 2.0)

S. NO.	FACTOR CALCULATED	VALUE
1)	EXTERNAL INPUT FACTOR	CF = 0.7 SEF = 0.776 EIF = $0.7 + 0.776 / 2$ = 0.74
2)	INT INPUT FACTOR	lfqtf = 0.7 ltef = 0.74 Uf (lib, lab, comp) = 0.76 Sdevf = 0.42 Int. input factor = 0.676
3)	TOTAL INPUT FACTOR	(ext. + int. factor) = 0.708
4)	OUTPUT FACTOR	R.F. = 0.64 S.A.F. = 0.81 output factor = 0.674
5)	PERFORMANCE EFFICIENCY	95%
6)	SYSTEM EFFICIENCY	67.4%
7)	OVERALL IMPROVEMENT FACTOR	1.0442