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Assessing Technical Institutions through the Principles of Total Quality Management: The Empirical Study – 2

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Abstract- The unprecedented expansion of technical education sector in India in recent years has brought many questions about the quality of education imparted. A technical education is relevant for the graduate if it meets the needs of the industry. A core set of such needs must be identified and to implement this concept in technical institutions, a number of studies were being carried out; models and strategies have been developed based on the principles of Total Quality Management. Total Quality Management (TQM) is a proven concept which is practiced in industry to establish standards to ensure the quality of products and services reach the end user. TQM is continuous improvement in quality. TQM should be led by the management and followed by entire institution to create learning ability, immovability and sustainability campuses.

This paper aims to study the perception of staff and students of three different institutions namely self financed autonomous institution (A), and self financed deemed to be status institute (B), and self financed private technical institution (C). Data were collected from staff and around 200 final year students of each institution. Questionnaires based on Malcolm Baldrige frame work as laid out in Brent.D.Ruben's excellence in higher education, which is a Baldrige based guide to organizational assessment, planning and improvement which are considered as the indicators of the quality. The data collected is analyzed using SPSS software of version 16.0 and two way analysis of variance (ANOVA) was employed to find out the significance of difference between the perceptions about the total quality management practices.

Index Terms- Technical Institutions, Quality, Perception, Significance, Statistical Techniques.

I. REVIEW OF LITERATURE

Education is goal oriented; accordingly Q of education has been seen with reference as Excellence in education (Peters & Waterman, 1982). It relies on the experiences, expertise, and commitment of all members of an organization to improve the processes by which customers are served (Lankard, Bettina A. 1992). In order to move forward and attain a higher level of quality in engineering education, the concept of total quality management must be applied. (Juried and Ritz, 1994).Anil R Sahu, Dr. R L Srivastava, Dr.R R Shrivastava (2008) enumerated the key factors which affect the effectiveness of the technical education from Indian point of view also suggested the seven important key factors affecting the effectiveness of the technical education from Indian perspective. Sam Pitroda (2008) the chairman of National Knowledge Commission in a letter to Prime minister of Republic of India, wrote Engineering education is among the key enablers of growth for transforming India's economy. The quality of teaching and research in this sphere will play a critical role economy. Huseyin Gul (2008) reported that the universities which adopt traditional management do not focus on the students needs in the process of education. Poh Ju Peng, Ainon Juhariah Abu Samah (2006) measured the student's satisfaction for quality and said that customer satisfaction is directly proportional to the quality. Dr,S S Mahapatra and M S Khan (2006) identified and analyzed the critical factors for the successful implementation of Total Quality Management and they considered 256 articles from journals and identified 20 critical factors for successful implementation of TQM in any organization. Management Leadership is a key factor in the success of TQM in higher education institutions (Tari, 2006). Sangeetha Sahney et al (2004) defined quality in education from TQM perspective and explores that the quality of education is becoming important, particularly so in higher education. Naik (2001) has strongly suggested that brining quality movement through application of TQM in Indian higher education will result in global recognition. R Natarajan (2000) explains the importance of institution accreditation in promoting the Quality Assurance of Technical education and demonstrated the indicators of student, faculty and institutional quality. Zbigniew Mrozek, Osei Adjei, Ali Mansoor (1997) stated that the philosophy of Quality Assurance and Total Quality Management are derived from the industrial and commercial practice and opined that maximum effort needs to be utilized from all the personnel and services involved in the process of the educational institution to make the Quality Assurance system worthwhile. Idrus (1996) described two approaches in implementing TQM in educational institutions viz, academic approach and strategic approach. Bolton (1995) and Green (1994) thinks that "the measurement of performance is an inescapable feature of TQM". Hence some measurement methods to ensure conformance to customer's expectations are necessary. Harris (1994) emphasized generic approaches to TQM. The first: student focus, Second: Staff Focus. Thus the reason why quality is difficult to manage in HE is due to the complicated nature of the educational product. Education has been viewed as a system or 'a network of interdependent components that work together to try to accomplish the aim of the system' (Deming, 1993). Bonser (1992) attributed the move

towards TQM in higher education to the lack of consistent leadership style.

II. OBJECTIVE

1. To study the perception of prime stakeholders (staff and students) about the principles of total quality management practices employed in different forms technical institutions.
2. To study the difference between perceptions of staff and students in general.
3. To study the difference between perceptions of staff and students of different institutions.

III. HYPOTHESIS

1. H_o : There is no significance difference in perception between institutions A,B & C about the principles of total quality management practices.
2. H_o : There is no significance difference in perception between stakeholders of institutions A,B & C about the principles of total quality management practices.
3. H_o : There is no significance difference in perception between interaction effect of institutions A,B & C about the principles of total quality management practices.

IV. METHODOLOGY

Questionnaires based on 7 critical factors such as organizational leadership, strategic planning, external focus, information and analysis, staff and student workplace focus, process effectiveness, outcomes and achievements (Refer annexure -1) which are considered as the indicators of total quality management program. these indicators of quality are further divided with 32 subdivisions of quality management and were distributed to around 200 final year students and around 100 staff of three different engineering college A, B & C (refer annexure - 2) in one of the technical education hub of south India. The respondents were asked to rank on a scale of 1-5 where 5 are considered as strongly agree and 1 strongly disagree. The data collected is analyzed statistically; Descriptive statistics of all the variables is listed below and two way ANOVA is employed to check the significant differences. If significant difference is found amongst the institutions then post- hoc test is conducted to know which group differs from the other two. Since there are seven dependent of variables in our analysis, we have applied the level of significance, that is value of alpha (α) = (0.05 / 7) = 0.007 which is termed as bonferroni adjustments.

V. DESCRIPTIVE STATISTICS

Stake Holder	Instn.	Mean	S.D	N
Staff	A	14.36	4.270	44
	B	16.43	3.690	7
	C	13.00	3.764	37
	Total	13.95	4.096	88
Student	A	16.89	4.531	75
	B	15.48	5.343	42
	C	12.67	4.183	45
	Total	15.35	4.961	162

Table 1.1) Leadership

Stake Holder	Instn.	Mean	S.D	N
Staff	A	15.18	4.886	44
	B	18.29	6.047	7
	C	14.19	5.364	37
	Total	15.01	5.234	88
Student	A	17.76	4.942	75
	B	16.43	4.794	42
	C	14.89	4.519	45
	Total	16062	4.911	162

Table 1.2) Strategic Planning

Stake Holder	Instn.	Mean	S.D	N
Staff	A	13.98	4.449	44
	B	16.00	4.435	7
	C	12.54	4.513	37
	Total	13.53	4.536	88
Student	A	15.63	4.983	75
	B	13.95	5.700	42
	C	11.24	4.618	45
	Total	13.98	5.271	162

Table 1.3) External Focus

Stake Holder	Instn.	Mean	S.D	N
Staff	A	11.84	4.000	44
	B	12.85	4.383	7
	C	12.48	4.256	37
	Total	12.86	4.525	88
Student	A	11.98	3.972	75
	B	12.10	4.017	42
	C	10.11	2.961	45
	Total	9.62	3.047	162

Table 1.4) Information & Analysis

Stake Holder	Instn.	Mean	S.D	N
Staff	A	11.66	3.894	44
	B	12.86	4.140	7
	C	10.84	2.949	37
	Total	11.41	3.551	88
Student	A	13.61	4.284	75
	B	12.24	5.016	42
	C	10.02	3.461	45
	Total	12.26	4.513	162

Table 1.5) Staff & Student work place focus

Stake Holder	Instn.	Mean	S.D	N
Staff	A	14.52	5.000	44
	B	17.57	2.299	7
	C	14.14	3.276	37
	Total	14.60	4.239	88
Student	A	16.59	5.134	75
	B	15.19	5.384	42
	C	11.96	4.157	45
	Total	14.94	5.370	162

Table 1.6) Process Effectiveness

Stake Holder	Instn.	Mean	S.D	N
Staff	A	11.20	3.867	44
	B	15.29	2.690	7
	C	9.97	3.411	37
	Total	11.01	3.828	88
Student	A	13.61	4.287	75
	B	12.29	4.419	42
	C	9.38	3.479	45
	Total	12.09	4.458	162

Table 1.7) Outcomes & Achievements

VI. LEVENE'S TEST OF EQUALITY OF ERROR VARIANCES

To test the null hypothesis that the error variance of the dependant variables equal across groups. The Levence's Test of equality of error variances is used to check the assumptions of homogeneity of variances. This test concludes that we have not violated the homogeneity of variances assumption for the variables except for 4, 5 and 6 which are found not homogeneous, hence Gomes Howell post – hoc test must be conducted for these 4, 5 & 6 variables, so as to check the difference of perception between different institutions, whereas for 1, 3 & 7 Hochberg post-hoc test is used to check the difference of perception between different institutions.

Table 2.1: Levence Test

Variable	**F**	**df1**	**df2**	**Sig.**
1	2.098	5	244	.066
2	.752	5	244	.585
3	1.124	5	244	.348
4	3.017	5	244	.012
5	3.867	5	244	.002
6	4.309	5	244	.001
7	1.464	5	244	.202

VII. TWO - WAY ANOVA TEST

Table: 3.1) Leadership

Source	Type III Sum of squares	Df	Mean squares	F	Sig
Corrected model	698.581	5	139.716	7.050	.000
Intercept	31314.363	1	31314.363	1580.121	.000

Stakeholder	6.141	1	6.141	.310	.578
Institution	414.680	2	207.340	10.462	.000
Stakeholder * Institution	123.614	2	61.807	3.119	.046
Error	4835.519	244	19.818		
Total	60739.000	250			
Corrected Total	5534.100	249			

1. F (1,244) = .310, P =0.578 > 0.007, hence there is no significant difference between the stakeholders.
2. F (2,244) = 10.462, P=0.000 < 0.007, hence there exists the significant difference between the institutions. Since perception about the principles of total quality management is significant different between institutions, post hoc test is conducted to find the difference amongst the Institutions.
3. F (2,244) = 3.119, P= 0.046 >0.007, hence the interaction effect between stakeholders and institutions is not statistically significant.

Post Hoc Tests:

Table 3.11) Leadership

Technique	Institution(I)	Institution(J)	Mean difference (I-J)	Std Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Hochberg	A	B	.35	.756	.956	-1.47	2.16
		C	3.14*	.639	.000	1.61	4.68
	B	A	-.35	.756	.956	-2.16	1.47
		C	2.80*	.804	.002	.86	4.73
	C	A	-3.14*	.639	.000	-4.68	-1.61
		B	-2.80*	.804	.002	-4.73	-.86

Table: 3.12) homogeneous subset

Technique	Institution	N	Subset	
			1	2
Hochberg[a]	C	82	12.82	
	B	49		15.61
	A	119		15.96
	Sig.		1.000	.953

Remark: Institution C differs from both Institution A&B.

3.2) Strategic Planning

Source	Type III Sum of squares	Df	Mean squares	F	Sig
Corrected model	482.264	5	96.453	3.969	.002
Intercept	37136.404	1	37136.404	1528.025	.000
Stakeholder	8.011	1	8.011	.330	.566
Institution	236.856	2	118.428	4.873	**.008**
Stakeholder * Institution	112.084	2	56.042	2.306	.102
Error	5930.060	244	24.304		
Total	70829.000	250			
Corrected Total	6412.324	249			

1. F (1,244) = .330, P > 0.007, hence there is no significant difference between the stake holders.
2. F (2,244) = 0.4873, P= 0.008, which is greater than 0.007 hence there exists no significant difference between the institutions. Since the test found no significant difference hence no needs to conduct post-hoc test.
3. F (2,244) = 2.306, P = 0.102 > 0.007, hence the interaction effect between the stake holder and institution is not statistically significant.

3.3) External Focus

Source	Type III Sum of squares	Df	Mean squares	F	Sig
Corrected model	638.971	5	127.794	5.533	.000
Intercept	27565.160	1	27565.160	1193.397	.000
Stakeholder	11.393	1	11.393	.493	.483
Institution	438.969	2	219.484	9.502	.000
Stakeholder * Institution	133.766	2	66.883	2.896	.057
Error	5635.929	244	23.098		
Total	54023.000	250			
Corrected Total	6274.900	249			

1. F (1,244) = .493, P = 0.483 > 0.007, hence there is no significant difference between the stakeholders.
2. F (2,244) = 9.502, P=0.000 < 0.007, hence there exists the significant difference between the institutions. Since perception about the principles of total quality management is significant different between institutions, post hoc test is conducted to find the difference amongst the Institutions.
3. F (2,244) = 2.896, P= 0.057 >0.007, hence the interaction effect between stakeholders and institutions is not statistically significant.

Table: 3.31) External Focus

Technique	Institution(I)	Institution(J)	Mean difference (I-J)	Std Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Hochberg	A	B	.77	.816	.718	-1.19	2.73
		C	3.19*	.690	.000	1.53	4.85
	B	A	-.77	.816	.718	-2.73	1.19
		C	2.42*	.868	.017	.33	4.50
	C	A	-3.19*	.690	.000	-4.85	-1.53
		B	-2.42*	.868	.017	-4.50	-.33

Table:3.32) homogeneous subset

Technique	College	N	Subset	
			1	2
Hochberg	C	82	11.83	
	B	49		14.24
	A	119		15.02
	Sig.		1.000	.701

Remarks: Institution C differs from both A&B

3.4) Information and Analysis

Source	Type III Sum of squares	df	Mean squares	F	Sig
Corrected model	394.848	5	78.970	5.348	.000
Intercept	19036.129	1	19036.129	1289.062	.000
Stakeholder	.498	1	.498	.034	.854
Institution	315.534	2	157.767	10.683	.000
Stakeholder * Institution	34.783	2	17.392	1.178	.310
Error	3603.252	244	14.767		
Total	37291.000	250			
Corrected Total	3998.100	249			

1. F(1,244) = 0.034, P = 0.854 > 0.007
2. F(2,244) = 10.683, P = 0.000 < 0.007
3. F(2,244) = 1.178, P = 0.310 > 0.007

Table: 3.41) Information and Analysis

Technique	Institution(I)	Institution(J)	Mean difference (I-J)	Std Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Games – Howell	A	B	.38	.694	.850	-1.28	2.03
		C	2.64*	.512	.000	1.43	3.85
	B	A	-.38	.694	.850	-2.03	1.28
		C	2.26*	.663	.003	.68	3.84
	C	A	-2.64*	.512	.000	-3.85	-1.43
		B	-2.26*	.663	.003	-3.84	-.68

Remarks: Institution C differs from both Institution A&B.

3.5) Staff and Students Workplace focus

Source	Type III Sum of squares	df	Mean squares	F	Sig
Corrected model	433.446	5	86.689	5.309	.000
Intercept	20134.370	1	20134.370	1233.081	.000
Stakeholder	1.071	1	1.071	.066	.798
College	243.411	2	121.706	7.454	.001
Stakeholder * Institution	100.423	2	50.212	3.075	.048
Error	3984.154	244	16.329		
Total	40178.000	250			
Corrected Total	4417.600	249			

1. $F(1,244) = 0.066$, $P = 0.798 > 0.007$
2. $F(2,244) = 7.454$, $P = 0.001 < 0.007$
3. $F(2.244) = 3.075$, $P = 0.048 > 0.007$

Table: 3.51) Staff and Student workplace focus

Technique	Institution(I)	Institution(J)	Mean difference (I-J)	Std Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Games – Howell	A	B	.56	.796	.759	-1.34	2.47
		C	2.50*	.528	.000	1.25	3.75
	B	A	-.56	.796	.759	-2.47	1.34
		C	1.94*	.782	.041	.07	3.81
	C	A	-2.50*	.528	.000	-3.75	-1.25
		B	-1.94*	.782	.041	-3.81	-.07

Findings: The Institution C differs from both A&B.

3.6) Process Effectiveness

Source	Type III Sum of squares	Df	Mean squares	F	Sig
Corrected model	683.310	5	136.662	6.030	.000
Intercept	32118.705	1	32118.705	1417.278	.000
Stakeholder	24.736	1	24.736	1.092	.297
College	371.212	2	185.606	8.190	.000
Stakeholder * Institution	248.572	2	124.286	5.484	.005
Error	5529.590	244	22.662		
Total	61121.000	250			
Corrected Total	6212.900	249			

1. $F(1,244) = 1.092$, $P = 0.297 > 0.007$
2. $F(2,244) = 8.190$, $P = 0.000 < 0.007$
3. $F(2.244) = 5.484$, $P = 0.005 < 0.007$

Table: 3.61) Process Effectiveness

Technique	Institution(I)	Institution(J)	Mean difference (I-J)	Std Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Games – Howell	A	B	.29	.870	.939	-1.78	2.37
		C	2.88*	.657	.000	1.33	4.44
	B	A	-.29	.870	.939	-2.37	1.78
		C	2.59*	.861	.010	.54	4.65
	C	A	-2.88*	.657	.000	-4.44	-1.33
		B	-2.59*	.861	.010	-4.65	-.54

3.7) Outcomes and Achievements

Source	Type III Sum of squares	Df	Mean squares	F	Sig
Corrected model	742.767	5	148.553	9.542	.000
Intercept	20425.061	1	20425.061	1312.023	.000
Stakeholder	5.586	1	5.586	.359	.550
College	487.171	2	243.586	15.647	.000
Stakeholder * Institution	197.153	2	98.576	6.332	.002
Error	3798.497	244	15.568		
Total	38834.000	250			
Corrected Total	4541.264	249			

1. $F(1,244) = 0.359$, $P = 0.550 > 0.007$
2. $F(2,244) = 15.647$, $P = 0.000 < 0.007$
3. $F(2.244) = 3.075$, $P = 0.048 > 0.007$

Table: 3.71) Outcomes and Achievements

Technique	Institution(I)	Institution(J)	Mean difference (I-J)	Std Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Hochberg	A	B	.01	.670	1.000	-1.60	1.62
		C	3.08*	.566	.000	1.72	4.44
	B	A	-.01	.670	1.000	-1.62	1.60
		C	3.07*	.712	.000	1.36	4.78
	C	A	-3.08*	.566	.000	-4.44	-1.72
		B	-3.07*	.712	.000	-4.78	-1.36

Table: 4.10) homogeneous subset

Technique	Institution	N	Subset	
			1	2
Hochberg[a]	C	82	9.65	
	B	49		12.71
	A	119		12.72
	Sig.		1.000	1.000

VIII. FINDINGS

Irrespective of variables, stakeholder is not shown any significant differences between staff and students. For institutions except variable number 2, shows significant difference @ $\alpha = 0.07$, The interaction effect between stake holder and institution shows there is no significant difference in the effect of both stake holders except for variables 6 & 7. Overall Institution C shows significant differences from the Institution A & B, hence the issues regarding institution C which is a self financed Private technical institution needs to addressed.

IX. CONCLUSION

Quality is very important aspect in all institutions especially technical education, since it bears a direct impact on the improvement of the education process.TQM relies more on processes than on products and is based on strong assumption that a product which comes out of a good process is always good. According to the study majority of the respondents are of the opinion that the TQM practices in technical education institutions in India are at average level or just above average level. All the stake holders who participated in the survey pointed out that the external focus of the technical institutes is lacking and expressed their concerns that more industry institution interaction needs to be developed, the study also reveals that the Outcomes and Achievements needs to be improved since these institutions have relied more on developing infrastructure, landscaping, advertisements rather than concentrating on outcomes and achievements. Especially private technical institutions in India have become money making centers than service provider and they spend their maximum time and money on how to attract the students and parents and also they don't have a practical approach or mechanism to measure and control the outcomes and achievements. Study also pointed out that the effectiveness of the process in technical education needs to be addressed. One of the other concerns as pointed out in the study is the involvement and commitment of top management and thus the above study seems to be adequate for predicting the significances about the perceptions of total quality management practices in technical education.

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ANNEXURE: 1

Study on total quality management practices in technical education: staff and students perspective

Sl.No	Description
1.	**Leadership**
1.1	Management supports improvement by providing appropriate resources, infrastructure and basic facilities in time every time.
1.2	All the students and staff are aware of institutional vision, mission, plans and goals.
1.3	Students and staff feedback, suggestions and complaints are used to the institution.
1.4	Management and principal shows a lot of initiative in academic as well as extracurricular activities
2.	**Strategic Planning**
2.1	The institution follows time table, test schedule, programs, sports, fests according to the calendar of events strictly.
2.2	There is a transparency of official procedures, rules and regulations, record keeping and maintenance of the documents in the institution.
2.3	All policies and strategies are communicated in advance and implemented well in time.
2.4	Students and staff are involved in the development of the institution.
2.5	Policies and strategies are regularly updated and improved.

3.	**External Focus**
3.1	Outside information and feedback gathered is regularly analyzed and used to improve institution.
3.2	Institution has a systematic approach to understand the needs, expectations and satisfaction levels of all the students, staff and parents.
3.3	Industry institution interaction is conducted on a regular basis.
3.4	Institution is committed improve communication and relationship with students, staff, alumni, parents, and corporate.
3.5	The institution always makes an attempt to understand the society'
4.	**Information and Analysis**
4.1	All documents are maintained neatly and retrieved transparently.
4.2	There is an effective approach for gathering information of departmental outcomes, achievements and progress.
4.3	Information and feedback collected is used to review, analyze and improve institution performance relative to set benchmarks.
4.4	Information and feedback used from leaders in the same field (competitors) for benchmarking this institutional process.
5.	**Staff / student workplace focus**
5.1	Our institution helps staff / students to develop their full potential and to contribute effectively to improve their knowledge.
5.2	Our institution encourages staff / students to participate in seminars, workshops, paper presentation and professional development activities
5.3	Institution has effective approaches for assessing and recognizing individual and team contributions of staff and students.
5.4	Our institution has a system for regularly assessing workplace environment and staff / student satisfaction.
6.	**Process effectiveness**
6.1	All work procedures are effective, efficient, standardized and well documented.
6.2	Institution follows documented and standardized procedures in all the work.
6.3	Standardized procedures are improved using innovation and creativity
6.4	There is a student councilor to coordinate and to develop rapport with the students.
6.5	Regular meetings with staff, students, parents and industry people are conducted to review the quality of education.
7.	**Outcomes and achievements**
7.1	The institution has documents to show the success and achievements.
7.2	The institution meets and exceeds the needs of all the students, staff, parents, alumni, industries, governments and nearby community.
7.3	The institution has a positive work climate, staff likes to work here and students like to study.
7.4	All benchmarks set a for the institution are either achieved or even surpassed.

ANNEXURE – 2

Sl.No	Type of institution
A	Self financed autonomous technical institution
B	Self financed deemed to be status technical institution
C	Self financed private technical institution