

## IMPLEMENTATION OF TOTAL QUALITY MANAGEMENT IN TECHNICAL EDUCATION - A Framework

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### ABSTRACT

*It is necessary to reform the current system of education. It must be changed from one which sorts, ranks and screens the youth of the nation to one which develops them into quality performers, at whatever level and in whatever field they choose to work. In today's engineering profession, a diversity of engineering approach is a necessity, for which the technical education has a primary responsibility to ensure that the graduate will approach industrial experience in a receptive frame of mind. Educational institutions need to become more responsive to the expectations of those they serve. Although the supply of engineers appears to match the demand, the direction and relevance of engineering education has been questioned. Quality-driven approach will help the institutions forge more effective partnerships with their primary customer, industry, in an age where economic power is vital to the well-being of the country. It will allow them to nurture a feeling of self-renewal and develop the means to actualize self-assessment procedures; and it will provide the institutions with a methodology and accompanying set of tools to make work processes more effective and efficient. Hence there is immediate necessity for the colleges and universities to imbibe principles of Total Quality Management to develop and deliver their services to delight the customer. The thrust is to graduate students who possess a natural orientation toward quality principles and a set of acquired skills to apply the knowledge on the field with little or no orientation. The paper discusses the inception of TQM, its misconceptions, prelude of its importance in the field of education in other countries. Its immediate attention in the technical education in the Indian context with a brief framework of its implementation.*

### 1. Introduction :

For a long time, "Quality" term was associated with the products. Initially, inspection and quality have been treated as inseparable, but later with the development of on-line quality control concept, statistical quality control has been developed. It is much later the industry realized that unless the quality of all the activities in the system are improved, it is not possible to improve the quality of the products. It has led to the concept of Total Quality Management (TQM). But, unfortunately, many

industries interpreted it in a narrow sense, that the TQM is to enhance product quality. TQM has to be taken in a broader sense in the larger interests of the society, and not in the narrow interests of the company alone. Practising TQM should lead to conservation of resources, particularly the vital non-renewable resources. It makes the society to enjoy those resources for a longer time, rather, for many generations. Practising TQM should also lead to the enhanced quality of worklife. It is found that sound worklife leads to the sound family life and there by

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a good harmony in the society. Improving the quality in a workplace, therefore, should not be confined to the products alone but touch upon all the facets of worklife. If this is accepted in principle, then one may ask where should it begin? The employees may be given a special training in TQM once they join the industry, but the natural way is to train them while they were learning as students in the college. It is not sufficient to simply teach TQM to them, it has to be made a way of life. In order to achieve that, the TQM has to be implemented in the place of education itself; i.e., in the schools and colleges and the students should be guided to perceive and practise TQM in all their activities. Later, when they join the employment, with little orientation, they take-up to practise TQM in a natural way. Before discussing about TQM in education, it is useful to look into the TQM in industry, its inability to produce the results as expected. This knowledge is useful to know the difficulties in TQM implementation and to draw out strategies to overcome them, during the course of its implementation in education.

## **2. TQM in Industry - Failures and Remedies :**

### **2.1. TQM Philosophy :**

Before discussing the state of TQM in industry, let us briefly revisit as to what is TQM ?

TQM is the combination of the socio-technical process towards doing the right things (externally), everything right (internally), first time, with economic viability considered at each stage of each process. TQM is a way of planning, organizing, and directing that will facilitate and integrate the capabilities of all employees for continuous improvement of anything and everything

in an organization to attain excellence. TQM is a tool to attack waste, inefficiency and mistakes.

The criteria that must be met for successful implementation of TQM are that :

- i) It must be based on a quality mind set and quality orientation in all its activities at all times, including every process and product.
- ii) It must be strongly humanistic to bring quality to the way employees are treated, involved and inspired.
- iii) It must be based on a decentralized approach, that provides empowerment at all levels, especially at the front line, so that enthusiastic involvement and common purpose are realities, not slogans.
- iv) It must be applied holistically, so that its principles, policies, and practices reach every nook and cranny of the organization.

### **2.2 Status of TQM in Industry :**

A survey conducted by Singh (1991) to assess the status of TQM in India revealed that only 39 companies, out of 1000 surveyed, are practicing TQM to some extent. However, he concluded that these 39 organizations were also not able to distinguish between TQM and quality control. Another survey conducted in USA (Benson, 1993) revealed that 25% of companies experienced success in using TQM techniques, and the rest failed largely because of poor application of principles. Benson felt that TQM has been getting a bad rap lately, because "failures" generate a lot of attention. He also found that many managers believe that (TQM) is all but dead and buried. However, those who are responsible for implementing TQM, feel that it is still in its infancy. And the prognosis from these people is that

both as a philosophy and a long-term business strategy, TQM is here to stay. Wellins (1993), said that TQM "is hardly in its geriatric stage." Thus, these conflicts can always be found while adopting a new philosophy, either soft or hard.

Thus it can be said that in most of the countries, TQM has become a fad. Industries have TQM programmes or workshops and many a time it is an end in itself and everybody gets back to the normal working style or schedule. Later they complain that TQM is a philosophy to be read and appreciated only. There has to be the conviction that, this is going to take a long time, and all the employees and the management have to work together as teams and learn the tools and techniques. In addition, many organizations think that they are quality organizations because they use teams and tools, but they don't examine the results.

### 2.3 Reasons for Failure :

Several authors have discussed the reasons for the failure of TQM. As summarised by R.R. Lakhe & R. P. Mohanty (1993) few of the important ones are being listed below. :

1. Inadequate knowledge and information about TQM.
2. TQM is considered as another bandwagon.
3. TQM being seen as a quick fix not as a long-term strategy.
4. Lack of strong commitment from management and failure to maintain its interest and commitment for long time.
5. Inappropriate ways of implementing TQM.
6. Doubts in the minds of employees about management's intention.
7. Resistance to change at different levels.
8. Insufficient Education and Training resources.
9. Poor internal communication.
10. Difficulty in measuring TQM's effectiveness.
11. Lack of awareness among customers, and difficulty in assessing customers expectation and satisfaction.

### 2.4 Measures to overcome the failure:

The authors have suggested a few generalised means by which TQM could be implemented so that the results could be encouraging.

- a) Approach should represent a total, systematic, integrated, consistent, organization wide perspective.
- b) Approach must be understood, advocated and supported.
- c) Approach must be owned by the organization.
- d) Everyone in the organization must continually foster an unswaying focus, open communication channels and strong sense of belonging.
- e) Entire organization must embrace it.
- f) Integrity, trust, respect, and fairness must never be violated.
- g) Foundation of basic business ethics must underlie all TQM efforts.

### 3.0 TQM - Where to begin ?

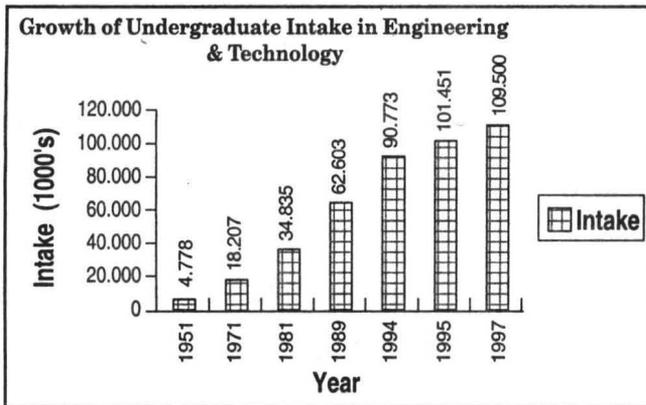
Quality should be completely and thoroughly embraced to become an integral part of all the activities of an organization. But quality cannot be made a way of life, neither through short and intensive programs or workshops, nor by celebrating some quality week/month/year. It has to be introduced much earlier in the career of a person, i.e., when he is a student.

Students should be introduced to total quality concepts ideally and TQM needs to be implemented in colleges, so that the concepts are internalised and imbibed before they enter their career. Education is the core for improving competitive advantage. Hence there is a greater need to translate TQM principles from the language of business and industry to that of the academics. Hence, total quality concepts must be woven into the content of core business and engineering courses, a process which began way back in 1989

in USA and other countries. However, this is not sufficient though essential. It is necessary for these institutions to provide quality education and develop students in all the facets in the larger interests of the society.

Adopting TQM is particularly more essential with respect to Indian scenario of technical education, as financial problems and industrial pressures, are challenging many technical education institutions, and they have no alternative but to offer "higher quality at lower cost."

**4. Scenario of growth of Technical Graduate Engineers in India :**



**Fig 1 : Growth of Undergraduate Intake in Engineering and Technology in India**  
 Courtesy source : ISTE handbook 1996-97 pp 257  
 Note that this does not include Technicians course (Diploma), MBA, MCA, Post graduate studies.

Period	Total Increase	Average increase/year
1951-71	13429	671
1971-81	16628	1662
1981-89	27768	3471
1989-94	28170	5634
1994-97	18727	6242
Comprehensive Analysis		
1951-81	30057	1001.9
1981-97	74665	4666.56
Intake increased by 4.5 times for the last sixteen years		

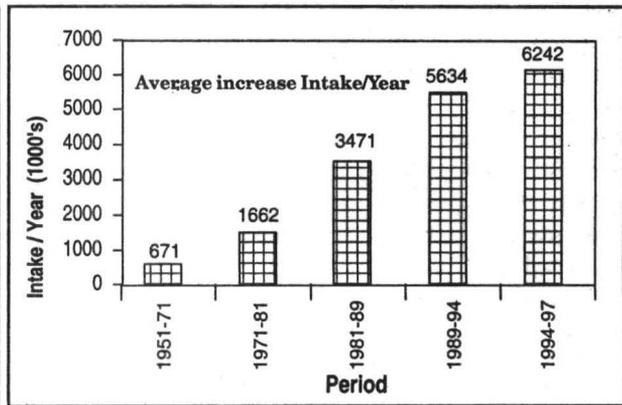


Table 1 : Average growth per year in Intake for the various periods

Fig. 2 : Average growth per year in Intake for the various periods

Like the commercial enterprises, education is also becoming more and more competitive. There is a rapid rise in the number of engineering colleges and

also the intake (Fig.1). It shows an exponential growth in the intake of the engineering degree courses. This represents the growth of colleges in India.

Though a very large percentage of the colleges were started in the four states of Andhra Pradesh, Tamil Nadu, Karnataka and Maharashtra, other states also have started permitting private colleges.

Figure 1 shows the growth of the undergraduate intake in Engineering and technology in India. Further critical analysis of the fig. 1 results in the conclusions, as depicted in table and fig. 2, that the intake or the rate at which the graduates are being produced from the educational institutions has increased by 4.5 times in the last sixteen years. Thus there is a phenomenal increase in the output of engineering graduates.

Our education system has basically been a Push type production system. The colleges in the private sector are established not for the need of the society/industries, but as a part of making a means of business. The outcome of this phenomenal growth has resulted in belittling the profession as there is significant amount of internal brain drain i.e. Engineering graduates taking up professions different from that of their qualification. On the contrary, the growth in industries is not commensurate with the growth of output of the graduates. Quality of the graduates is yet another greater concern, as there is little match between the services that our colleges and universities provide and the customers (industry, society etc.) require. The knowledge, skills, and practical experience of the graduates does not make an immediate and positive contribution to the productive work of an organization. This occurs basically because of:

- i) Most of the colleges have no vision of what it would like to be in the future.
- ii) Failure of the institutions to identify whom it wishes to serve and what these potential clients want and needs

of students, needs of recipients of research and services, needs of community.

- iii) Absence of identified values that guide its actions.
- iv) Failure of commitment for improvement.

With the rapid development of technology, customers being quality conscious, only the educational institutions that provide quality education are here to stay in the future. The large output of the engineering graduates leads to a large unemployment, and the students may not opt for engineering courses, i.e., the demand may decrease. With the unprecedented growth of technical institutions, there is going to be a stiff competition between the institutions in such a situation. To be in competition, institutions will have to improve the quality of education and the service they provide to the customers. This requires the definition and assessment of who are their customers and what are their wants. It then entails realigning the organization to deliver education and the service that meets, and aims to exceed, the expectations and needs of the customers. Quality engineering education is the development of intellectual skills and knowledge that will equip graduates to contribute to the society, to a productive and satisfying engineering careers, as innovators, decision makers and leaders in the global economy of the 21st century. Quality engineering education demands a process of continuous improvement and innovation in curriculum, teaching methodology, infrastructure and administrative activities. This can be achieved by systematically and collectively evaluating and refining system, their practices and culture in technical institutions.

**4.1 Education from the system's perspective :**

Fig 3. Depicts educational system where the students turned out to a qualified person perform a specific task needed by the society. Looking into the Educational system with student as input (fig 3), there is a need to enhance the student's professional core competency, social core competency, personal development and continued learning competency. In most of the institutions, the emphasis is mainly on the development of professional core competency to a greater extent, with little or no emphasis on the remaining three. Result of which is the development of technocrats and not the citizens suitable to the society. The greatest concern at this stage is to look into all possible developments.

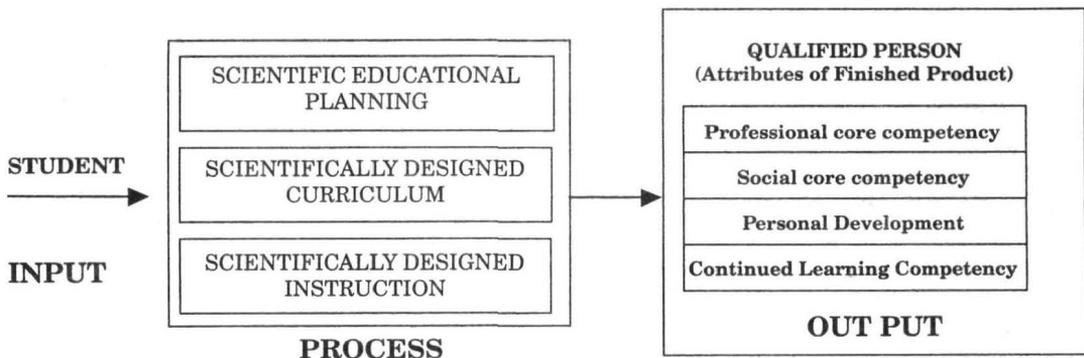
In this knowledge age society, national advantage will increasingly be derived from an educated and empowered work force that can quickly adapt to the dynamic requirements of a changing world. For today's engineering profession, a diversity of engineering approach is a necessity, for which the technical education has a primary responsibility to ensure that the graduate will approach

industrial experience in a receptive frame of mind. Sustainable advantage will be enjoyed by those societies which best elicit value from human resources. As discussed earlier the societal needs and the interests are of utmost importance and TQM helps to realize them in a better manner. Hence the need to adopt TQM.

Thus the quality movement appears to be making inroads into the sacred halls of education. Because a quality-driven approach will help the institutions forge more effective partnerships with their primary customer, industry, in an age where economic power is vital to the well-being of the country. It will enable institutions to become more responsive to the expectations of those they serve i.e., the students, the Government, the parents and so on. It will allow them to nurture a feeling of self-renewal and develop means to actualize self-assessment procedures. It will also provide the institutions with a methodology and accompanying set of tools to make, work processes more effective and efficient.

The other factors that facilitate the need for the implementation of TQM in technical education are:

- 1) Loss of faith by institutions



**Fig 3 : SYSTEM'S PERSPECTIVE OF TECHNICAL EDUCATION**

- customers (students, industries etc.).
- 2) Desire of the educational institutions to acquire a competitive edge.
  - 3) To have a far better match between the services that colleges and universities provide and what their customers require.
  - 4) For years, industry has accused academia of not teaching anything relevant. And for years academia has been replying that they are the bastion of theoretical purity and that industry better start using outcomes of educational research.

#### 4.2 Lessons to be learnt from the developments taking elsewhere:

##### A Prelude of TQM in Education :

As reported in Introduction to "IBM-TQM Partnership" (Seymour, 1993), IBM-hosted a Sharing Conference in 1993, to facilitate information exchange among the nine IBM-TQM Partnership universities to accelerate the teaching, research, and use of quality management practices in college and university operations. The basic purpose of the partnerships was :

- a) **The Driving Needs:** For pursuing a quality management agenda on college campuses.
- b) **Curriculum Development :** Dealing with embedding quality management principles into core business and engineering courses;
- c) **Research :** Conducting research on issues related to quality management.
- d) **Running the University :** Using quality management to improve university administration and
- e) **Propagation and Sharing :** The process by which you plan to propagate and share research findings and TQM integration plans with other colleges and Universities. Georgia Tech went one step further, to

state, "We plan for every undergraduate student to graduate from Georgia Tech with an understanding of the TQM philosophy and the essential knowledge, skills, and practical experience to make an immediate and positive contribution to the productive work of an organization."

The IBM/TQM partnership inferred that TQM implementation leads to organizational transformation and also enhances the effectiveness of higher education's role as a supplier of knowledge and learning resources to a nation whose industries are trapped in an economic battle for survival.

By the end of the 1992-93 academic year, well over half of the 3500 postsecondary institutions in the U.S. had either implemented or were seriously considering Continuous Quality Improvement (CQI) programs, including comprehensive research institutions like Michigan, Pennsylvania, Cornell, and Wisconsin. CQI was a major theme of American Association of Higher Education (AAHE), where universities are being increasingly held accountable to their customers & stakeholders.

University of Wisconsin-Madison (WMU) embarked on a systematic, universitywide, strategic planning process and adopted the principles and practices of CQI, defined as "doing the right thing in the right way the first time. WMU endorsed a mission statement with five major components: high quality instructional programs whose outcomes could be assessed, expanding research outcomes, contributions to the economic development of the region and state, community service, and increased diversity among students, faculty, and staff. Their primary concern of higher education was also "accountability to the people they served." Learning from the

developments of other countries and the need for the transformation in technical education."

A framework is proposed here for adopting TQM in technical education in India.

**5. Framework for Adoption of TQM in Education :**

The educational system is essentially a feedback control system where it transforms a learner into the learned as shown in fig. 4. Here, only training of students to become engineering graduates is only considered, a task performed by many Engineering Colleges. Some colleges may also provide services like research projects, consultancy, Executive development programmes, those are not being considered.

The Feedback controlled educational system includes an input in the form of a student, who has a desire to enhance his competencies to suit the requirements of the ultimate customer. The input or 'raw material' is normally determined through the admission process. But this old practice of controlling quality primarily through

selecting only high-quality students will no longer be feasible for most of the institutions amidst this mushrooming of engineering colleges. In lieu of this, it calls for a greater emphasis on the quality of the educational process rather than the selection of the quality input.

Educational process consists of course content, teaching methodology, learning environment and infrastructural facilities. The infrastructural facilities have an impact on learning environment. As the educational process also includes the employees of the institutions, every individual of the organization (i.e. teaching, non-teaching, administrative employees & the management) must accept the personal responsibility for achieving organizational goals and accomplishing its mission, particularly the teachers.

Output of the educational system is a graduate with the enhanced skills, competencies and knowledge. The measure of the quality of the output is the extent to which a graduate has acquired the four attributes of qualified person as given in fig.3.

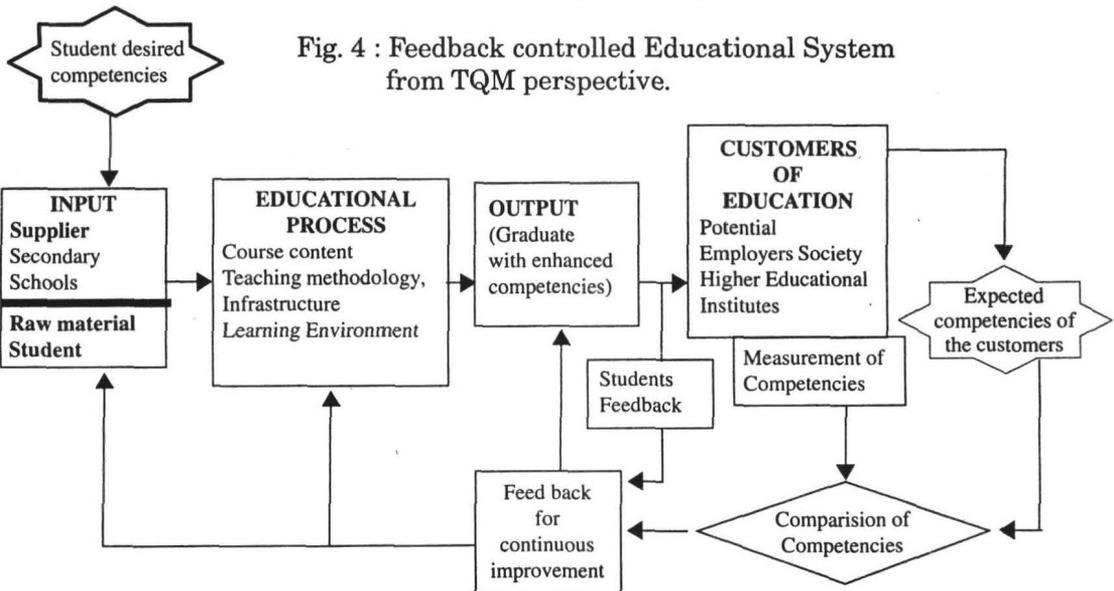


Fig. 4 : Feedback controlled Educational System from TQM perspective.

The output may be measured by

- i) The ultimate customers, industry and the society, compare with their expected competencies and may provide feedback to the educational institution.
- ii) The student graduate may measure himself, against his own desired competencies or with similar graduates from the other institutes and may provide this feedback to the institute.
- iii) The institute if proactive, may itself measure their output and compare it with expectation of the industry and the society. They may use these results as a feedback for improvement.

The feedback may cause

- i) Change in the curriculum.
- ii) Enhance the infrastructural facilities like library, laboratory, computing facilities etc.
- iii) Enhance the teaching methodology using appropriate educational technology.

or the feedback may cause :

- i) Admitting good quality students only, irrespective of the number i.e. keeping a cutoff mark during intake.
- ii) May motivate the upstream, i.e. the secondary schools to enhance their quality.

The more important task therefore is to change the educational process. In order to design, maintain and enhance the educational process, TQM serves as an appropriate tool.

TQM implementation requires primarily understanding the concept of culture in the organizations, as implementing a successful TQM package, utilized somewhere else does not

necessarily succeed. Hence, of the need to have an in-house TQM culture. This cultural transformation is based on the organizational history, characteristics of the organization, attitude of the members, which needs to be tuned through an iterative process of improvement and gradual transformation to accept the fact that this change is inevitable, for a better tomorrow for the survival of the organization. Cultural transformation should indoctrinate the confidence that TQM implementation in the organization will lead to improved results. Hence to develop and implement a new approach to institutionalize the quality, the fundamental cultural changes must occur. When TQM systems are not designed to fit cultural circumstances, it is a common reason for failure. Cultural transformation is more said than done. To bring about this cultural transformation, look at the organizational structure of a technical institution as shown in fig. 5.

Top Management must not see any new approach like TQM as a way to make "those lazy workers" more productive. It is not that top management can impose the implementation of TQM in the institution, it should be brought about in a natural way in the system. It is the culture that brings about this transformation. How to go about to bring this transformation?

At the departmental level, bring the people together on a common platform. Elucidate about the basic statistical tools like Pareto diagrams, Histograms, Cause Effect diagrams (C.E.D.), control charts etc. & some techniques of brainstorming. The learning should be brought about in such a way that it is an enjoyable experience, i.e., through the interesting practical cases of which employees are

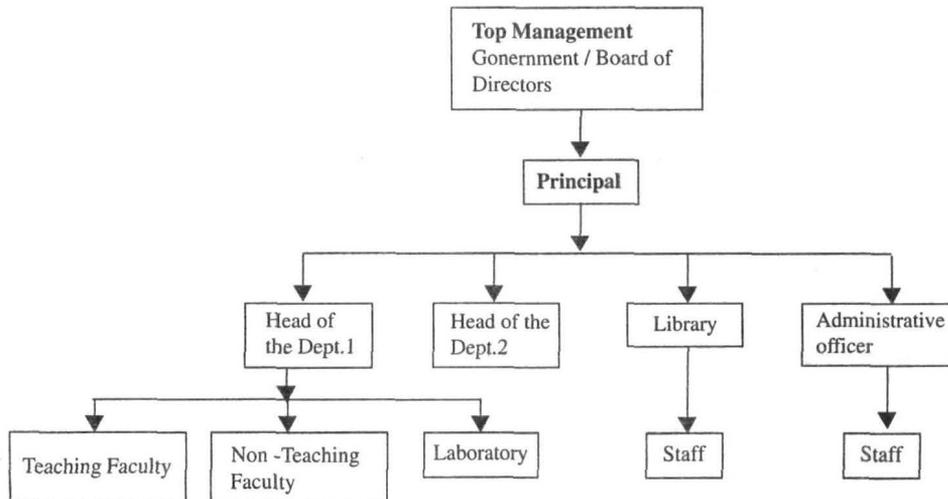


Fig. 5 Organizational Structure of Technical Institution

familiar. In order to help them to use these tools, identify areas where there has been success in the department. Ask them to brainstorm, to list out the possible causes for the success, and represent the same using the quality tools like CED. By which, not only do they consolidate their learning, but also identify their strengths in them. As success breeds success, knowing their strengths in them they start having a self-confidence in themselves. Gradually this process could be applied to all the areas, to ascertain their strengths, weakness, opportunities and threats. This process should pervade all the departments, library faculty and the non teaching faculty too, to assess their capabilities. Thereby give them an idea, as to how the services provided by them could be enhanced, with little or no effort, but merely by channelising resources properly. So that every individual in the institution is involved. As this progresses, by about an year the culture gets ingrained in the system. By now every individual knows himself, his capabilities. This should help in establishing the

departmental as well as the institutions Strengths, Weaknesses, Opportunities & Threats analysis and the people are made aware of it. Once this culture for change has been established, to be competitive a specific a quality based mission, a strategic vision and clear set of objectives, needs to be developed. The organization's values, mission, and goals must be clearly and specifically defined so that everyone in the organization knows what the end objectives are. This is followed by:

- 1) Identifying the institution's stake holders.
- 2) Identifying both the internal and external customers, of the education system.
- 3) Conducting the requirement analysis of both the customers and the stakeholders.
- 4) Conducting a SWOT analysis of the institution through free debate, to assess its situation. It allows an institution to validate its current mission, to come to an agreement with the customers initial vision. It also enables to identify the weaknesses

and the external forces that threaten its progress.

- 5) A strong leadership to communicate continuously to faculty, staff, other members of the institution and students, the mission and goals, values, and vision.
- 6) Identifying the process ownership to make the necessary changes in the education setup. To some extent the University or the Management owns the process and they have to initiate the changes. However, every individual owns more of the processes than is recognized. But a thought needs to be given to trace how ownership could be taken by each of them. If the culture is tuned well, then this task of ownership becomes easy.
- 7) Identify the critical processes teaching, research, and service.
- 8) The institution must arrange for faculty orientation to TQM, train its personnel at all levels to ensure sufficient skills to accomplish the mission and thus foster an environment where everyone grows with a focus on the chosen future.
- 9) Employee involvement is an essential component in defining and implementing quality service. Every employee must be encouraged to make quality service the driving force in his or her work. Quality can't be done alone-the use of cross-functional teams not only produces better outcomes, but provides the ownership necessary to motivate change.
- 10) Establishing internal measures for quality and excellence in specific and identified area.
- 11) Constant evaluation of the systems must become routine to know how successfully the goals are being achieved and the mission being fulfilled. Push decision making to the lowest appropriate level, creating an attitude of interdependence and trust throughout the institution.
- 12) Organizational excellence doesn't just happen-continuous improvement must be structured and ongoing, in order to achieve institutional excellence and maintain the quest for excellence.
- 13) Recognize and reward those who work hard to improve quality. Reward "interesting failures" as well as interesting successes. So that the momentum in the newly launched effort doesn't get lost.
- 14) Realign the implementation of its activities with its mission and values. Achieving quality improvement demands hard work and self-discipline. Hence, meticulous planning in the long range perspective would result in the concept of a unified college community. It focusses on improving student's lives to match the requirements of the society to produce apt citizens suitable to the country.

#### Conclusion :

Education and in particular technical education is being driven towards commercial competition imposed by the economic forces. With the mushrooming of engineering colleges, the competition is becoming intense on one hand and the reduction of the governmental funds on the other, is forcing the educational institutions to revamp their strategies to combat this change, Institutional change based on cultural revitalization and reconfiguration is necessary to begin with.

There is a need for systematically improving the educational environment

to meet the needs of customers. But multiple customers entangle in complex relationships forcing the educators to grapple with the identification of just who their customers might be. With a strong leadership and commitment from every one and the base support, institutionalising TQM should not be difficult. Quality education results from a multi-faceted effort of every member of the institution-students, their families, alumni, the community and faculty.

TQM pursuit is three steps forward & one step back. The initial period is focussed on quality awareness, infrastructure, measurement systems & new skills. As measurement improves, institutions begin to see problems more clearly. The realization that the things are not going as well as expected causes disappointment, anxiety & sometimes panic. There is a tendency to look for quick results, rather than at long-term improvement. First year results are typically not achieved until third or fourth years. Quality programs may be sabotaged because of this impatience.

There are many layers of bureaucracies like the Ministry of Education, Director of Technical Education, Universities, Management, high turnover at the top will inhibit TQM because it takes longer than four or five years to have its effect being felt. So frequent turnover in upper management causes problems. Institution has to have stable leadership to really change its traditions and culture, which is very rare to find. Hence quality doesn't happen overnight i.e, it is not a "quick fix" or "instant cure" but an ongoing process that requires an gestation period of at least 5-10 years.

Measuring ourselves against the award criteria similar to that of Malcolm

Baldrige award criteria for education provides valuable feedback, a clear perspective on the distinction between typical performance and world-class performance. There is need to develop such criteria measures. Technical Institutes also need to have partnerships (like IBM-TQM partnerships with Universities) with industries to have a better match between the services that our colleges and universities provide and what they require. Hence the acceptance of TQM as a viable, philosophical approach to improving the educational system-remains a very long way off. Only the time will tell as whether TQM in Higher Education is yet another fad or lasting legacy?

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