

1. DEVELOPMENT OF TOTAL QUALITY ENGINEERING EDUCATION MODEL USING QFD

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INTRODUCTION

The development and socio-economic condition of a nation is determined by enhancing the quality in Engineering education. There is a greater need for high quality education to produce technically skilled and creative man-power in India.

Quality engineering education is the development of Intellectual skills and knowledge that will equip graduates to contribute to society through productive and satisfying engineering careers as innovators, decision - makers and leaders in the global economy of the 21st century.

In fact, Engineering education is a process of developing and mobilizing human resource to be used later as input to industry which in turn produces goods and services for the societal use. Education without quality is not only useless but also potentially dangerous. Equipping the students with wrong skills can be fatal not just to the individual but also to the society as a whole. Engineering graduate passing out from the college has to fulfil modern and high standard requirements that are needed by industry, government and other sectors from society. The educational institutions must strive to impart quality education and have to create greater satisfaction in their customer group. The Total

Quality Management (TQM) helps to accomplish this task. TQM is the management philosophy and can be defined as the process of ensuring customer satisfaction from the time of manufacturing the product to the time that the customer uses the product. For an educational institution, it can be defined as the process the educational institution undergoes to disseminate knowledge and develop skills in the students that are needed to be productive or gainfully employed in the discipline one is trained for.

Quality Function Deployment (QFD) is one of the important techniques of TQM. It primarily concentrates on the customer needs and the identification and ranking of the necessary design requirements that would satisfy the customer needs. It can be used to measure customer satisfaction, which is the main concept of TQM. So QFD can be applied for achieving the goal of Total Quality in Engineering Education.

QUALITY FUNCTION DEPLOYMENT (QFD)

"Quality function" is defined as the collection of activities through which we achieve fitness for use. "Deployment" is the Japanese word, which refers to an extension or broadening of activities. Thus, "Quality Function Deployment" means that responsibilities for producing a quality item must

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be assigned to all parts of a corporation.

QFD was developed in 1966 by Dr. Yoji Akao and Dr. Shigeru Mizuno as part of the implementation of TQM. QFD did not become a viable methodology until 1972, when it was applied at the Kobe Shipyards of Mitsubishi Heavy Industries in Japan. QFD reached its peak in Japan in 1970's when Toyota Auto Body developed a quality table that had a "roof" on top, and nicknamed this quality table as a "Quality House" which is also known as the "House of Quality" in the United States. The formal introduction of QFD to the United States and Europe was not until 1983. The first recorded case studies in QFD were in 1986 when Kelsey Hayes used QFD to develop a coolant sensor, which fulfilled critical customer requirements. In India also, QFD is being used, although not by many companies, to offer customers what they desire. A prominent example is Telco employing QFD to design and launch its 3 box Sedan. In the present scenario, the service organizations are widely adopting the concept of QFD with a view to improve the service quality. In the spring of 1991, the Mechanical Engineering Department of the University of Wisconsin, Madison used QFD to obtain students' feedback to change the undergraduate curriculum. This has been claimed as the first application of QFD in education.

QFD METHODOLOGY

The brief overview of QFD methodology is shown on flow chart diagram in Fig. 1.

Step 1: Determining the voice of the customer (customer needs). The voices of the customer are required to begin a QFD process, which can be obtained on the basis of experience with customer or on survey reports.

Step 2: Determining the priority structure of customer needs and preparing the competitive evaluations of customer needs.

Pair-wise comparison of customer needs using Analytical Hierarchy process (AHP) is the best

way for obtaining the priority structure of customer needs. The priority structure indicates the relative importance of needs. The customer plays an important role in determining the relative position of the organization with respect to that of its competitors for each customer need. This competitive assessment of customer needs can be accomplished through survey of customers, which includes questionnaire survey, direct interviews, telephonic interviews, interaction through e-mail etc.

Step 3: Develop the customer portion of QFD matrix.

The horizontal portion of the QFD matrix is concerned to the information related to the customer. The list of customer needs, priority ratings and competitive assessment of customer needs are occupied with a proper order in this customer portion.

Step 4: Develop the Technical portion of QFD matrix.

The vertical portion of QFD matrix is related to the technical data. Once the customer needs are identified, QFD team can establish appropriate design requirements that would satisfy those needs. Competitive technical assessment is also executed by the QFD team for obtaining the target ratings for each design requirement. Inter relationships for customer needs and design requirements are established, which are placed at the middle of the technical portion of the QFD matrix. The co-relationship of the design requirements can be examined. The objective is to highlight any requirements that are in conflict with each other. If action on one item will harm another item, this negative effect needs to be resolved. The triangular portion accommodates these co-relations, which gives the overall QFD matrix the appearance of a roof top. As a result, the QFD matrix is referred to as the House of Quality. Column weights can be calculated, which are developed by using the customers' importance levels in conjunction with weights assigned to the relationship symbols. The resultant number provides a method of judging the relative

importance of each of the design requirements. Column weights can serve as an index for highlighting those design requirements that have the largest relative effect on the product. These column weights are entered at the bottom of the technical portion of the QFD matrix.

Step 5: Analyse the QFD matrix.

Once this QFD matrix is completed, the analysis stage begins. The chief focus should be made on the appropriate design requirements to obtain the complete satisfaction of customer needs in the order of final ranking. To fulfill each design requirement, what all the necessary steps to carry out are analysed.

**TOTAL QUALITY ENGINEERING
EDUCATION MODEL**

Education can also be termed as knowledge industry, which needs to calibrate itself to the user needs. The students who are entered in an engineering educational institution are the raw materials which may be converted in to final products called engineering graduates to meet industry expectations. In this context the industry may be treated as external customer. The education sector that produces the human resource has a pivotal role in the quality movement that demands total quality approach in the education system to live to the requirements of the industry. To achieve total quality education, the institutions must consider the voice of customer i.e the expectations of the industry while formulating the organizational policies, so that they would be able to establish the suitable design requirements for achieving the goal of total quality education. QFD technique helps to accomplish this task. The QFD procedure deals with the identification of customer (Industry) needs and finding the ranking of the design requirements to meet the industry needs that lead to the total quality engineering education. Identification of industry needs and establishing the rank order for design requirements are essential for achieving the goal of total quality education; it also requires a coordinated effort from various people and institutions. Total quality engineering

education model is shown in Fig.1, which is developed through QFD concept.

The industry needs, which are expected to be available in Engineering graduates that are mentioned in the model are arrived through several discussions which were made with experts in human resource departments of various industries. The set of design requirements shown in the model were generated through the brain storming sessions held with the eminent faculty, principals, training and placement officers and librarians of the engineering colleges. QFD methodology is adopted by collecting the responses from questionnaire survey. The rank order of the design requirements depends on the competitive assessments based on industry needs and design requirements.

The engineering colleges have to pay more attention on the implementation of the design requirements in rank order towards achieving total quality in education so as to meet the expectations of the industry.

To ensure this task, there should be effective management and leadership to coordinate all the activities towards total quality engineering education. The leadership and management in education system have a key role in providing quality culture education. While leadership focuses on mission, direction, inspiration, the management involves in designing and carrying out plans, getting the things done and working effectively with people. In order to obtain the right kind of leadership and quality management, the aspects to be considered are culture and environment, mission and vision, planning and control, responsibility and accountability.

It may be advised to consider the following list of factors while formulating the organization policies and improvement of facilities.

BETTER COURSE PLAN AND CURRICULUM

Flexibility in updating the curriculum according to the modern technological trends is essential. Curriculum should make the student close with the external customer's demand. It may be advised to introduce apprenticeship-training program. Sandwich training practice as a part of curriculum.

INDUSTRY-INSTITUTION INTERACTION

In order to provide practical orientation in teaching, the institution needs to constantly interact with industries and carry out consultancy works, project works and seminars.

MODERN COMMUNICATION FACILITIES

It includes LAN, access to internet, connection of regional libraries by WAN, E-mail and Fax and it helps the students and faculty for solving complex mathematical models and for obtaining latest information.

MOTIVATED FACULTY

The motivated faculty can only put their sincere efforts to establish quality education. The important attributes that motivate the faculty may be work time flexibility, transparency in administration, providing salaries and perks as per norms, individual computer, access to internet, telephone, fax facilities, health-care facilities, staff quarters, recreational facilities etc.

OPPORTUNITY FOR KNOWLEDGE UP-GRADATION

Implementation of Quality Improvement Programs (QIP), mutual exchange (Industry-Institution) programs, sending the students and faculty to various technical conferences are necessary to create the environment of knowledge up-gradation.

LIBRARY MODERNIZATION

In the present technological environment the modernized library called Digital library that consists of the facilities like OPAC server, CD-server, Internet Server, LAN, CD- Video facility etc which leads to user satisfaction increased through qualitative improved service.

VISUAL TEACHING AIDS

Visual teaching aids help the faculty to teach a concept more effectively. It includes OHP, LCD, Slide projectors, Video films on advanced topics, prototypes, etc. which are required to make the learning process faster and easier.

WELL DISCIPLINE

Discipline is a pre-requisite for the development of any institution. It should adopt a firm policy to achieve discipline at various levels of educational institution.

CAPABILITY TO ATTRACT COMPANIES FOR CAMPUS INTERVIEWS

Better hospitality for the interviewers, rigorous practical training, industrial visits, personality development programs, implementation of the concept of team work, handling industry based project works etc. are necessary to attract the companies for campus interviews.

CONCLUSIONS

QFD establishes the ranking of the design requirements for obtaining the customer satisfaction. It provides a systematic approach and indicates a proper order in which the institution has to enrich its facilities. Total quality education is not a result of any gimmicks; it needs an unconditional commitment and continuous effort by every participant in the system. Education policy makers and implementers in government, the leadership and management of educational

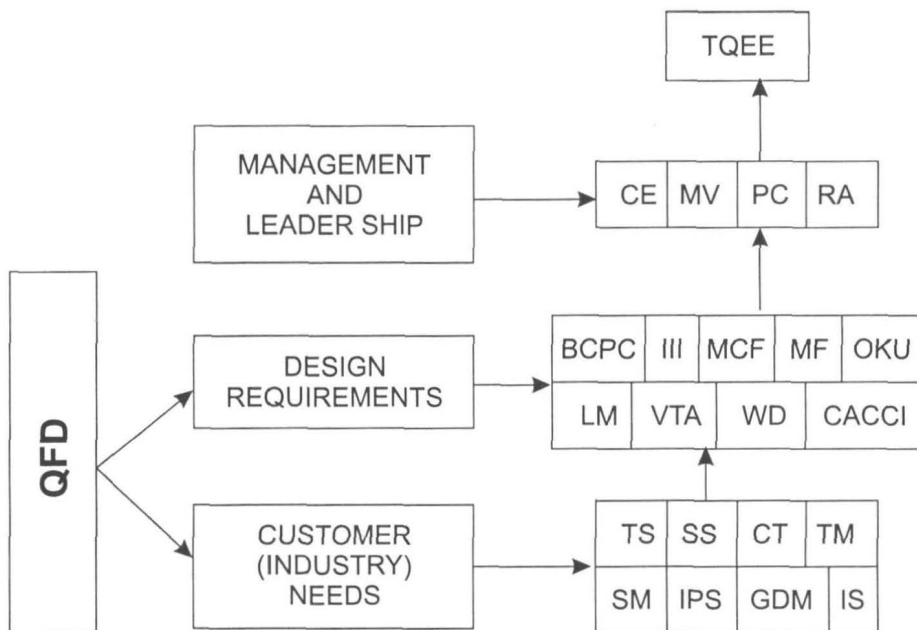
institutions, teachers, students and parents have a significant role to play in this task.

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TOTAL QUALITY ENGINEERING EDUCATION (TQEE) MODEL



CE : Culture Environmnet

MV : Mission and Vision

PC : Planning and Control

RA : Responsibility and Accountability

BCPC : Better Course Plan and Curriculum

III : Industry Institution Interaction

MCF : Modern Communication Facilities

MF : Motivated Faculty

OKU : Oppourtunity for Knowledge Up gradation

LM : Library Modernization

VTA : Visual Teaching Aids

WD : Well Discipline

CACCI: Capability to Attract Companies for Campus Interviews

TS : Technical Skills

SS : Soft Skills

CT : Creative Thinking

TM : Time Management

SM : Stress Management

IPS : Inter Personal Skills

GDM : Good Decision Making

IS : Innate Skills

Fig. 1