Study to Improve Diploma Level Technical Education through Quality Function Deployment (QFD)

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ABSTRACT: - Quality Function Deployment (QFD) is one of the techniques of Total Quality Management (TQM) tools. Specially Technical Education is backbone of Industries and Society and is very important to the development of a Country. Quality Assurance in Technical Education is to provide confidence to the Professionals, Students and their Parents, Employers and various Stakeholders. QFD identifies the factors which are responsible to transforms the Customer's requirements into the Product/ Services. This paper is based on observation in Diploma Level Technical Institute and feedback of Students and Faculty of the Institute. The main purpose of this study is to minimize the gap between Student's requirements and Performance of the Institute. Efforts are to be made for providing Skilled and Efficient Manpower to Industries. Various Parameters have been identified and marked them to be taken in to corrective action. Collective actions are to be needed from Management, Faculties, Supporting Staffs & Students themselves in order to achieve their requirement. House of Quality indicates the Priorities of enablers (Technical Requirements) to fulfill the Student's requirement.

Keywords: House of Quality, Diploma level Technical Education, Quality Function Deployment, Total Quality Management, Curriculum Design, Customers (Students) requirement

1. INTRODUCTION

Total Quality Management is essential for survival of any product or service. Present scenarios are competitiveness in industries and all sectors of economics activities. TQM applied various business organisations such as, health care centre, government departments, educational institutes, banking sectors, public transportation, mining and utility centre etc. TQM become the integrated part of most of the firm for delivering product or services.

Quality Function Deployment is the technique based engineering analysis and comparative study. "Quality function" is defined as the collection of activities through which one achieves 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 [1]. The purpose of a technical institution is to prepare the youths competent in technical as well as problems solving ability. Students are considered as customers and Teachers are as Technical Descriptors. In present era, Stakeholders are demands the variation in the process of teaching-learning method to meet the current challenges of market and industries.

Quality of technical education depends on execution of theoretical knowledge into practical. For this point of view good infrastructure, equipped laboratory, effectiveness of teaching-learning process, well updated curriculum, latest books and digital library facilities, industrial attachment for exposure and visit, working environment, attitude and commitment of students and faculty brings ultimately the satisfaction to all. "Quality in higher education is a complex concept that has eluded clear definition" (Marshall, 1998). In technical education various stakeholders such as students, parents, employers, government, industries, commercial market, engineering colleges, various agencies, accreditors, validators, professional bodies etc. (Harvey and Burrows, 1992). Every stakeholder is having own concept about the quality influenced by own interest and purpose.

The quality of diploma level technical education rely on many key elements such as Teaching-Leaning method, infrastructure, laboratories, workshop, design of curriculum, industrial attachment, exposure to students, etc. Teaching staff and supporting staff play vital role for delivering appropriate working environment. The central government and state governments wants to make skilled India. Therefore, the role of Industrial Training Institutes (ITI's) and Polytechnic colleges are of great importance to produce skilled, trained and capable engineers. The present work identifies the key factors to satisfy the demands of students and make them enable to serve the industries and society.

2. LITERATURE REVIEW

Quality Function Deployment was invented in Japan by Yoji Akao in 1966 [9], but was first implemented in the Mitsubishi's Kobe shipyard in 1972, possibly out of the teaching of Deming. Then later it was adopted and developed by other Japanese companies, notably Toyota and its suppliers. QFD can be applied for process and design improvement. It develops a framework for a quality in an educational institute and a relationship matrix between Dimension of Quality and Enablers [2].

In a technical institute QFD may be used for planning and improvement of quality to gain a competitive edge by satisfying student needs. Importance ratings obtained by a questionnaire from students and faculty for construction of house of quality [3]. QFD is a team based management tool in which customer's expectation are used to manage the design of the process [4].

Companies in present use market research to identify the product to produce and means to satisfy customer requirements. Contradiction in customer requirements leads to diversity in product variant and customer often cannot explain their expectation. Confusion and misinterpretation of customer requirement also affects to design and manufacturing as per requirements. Therefore, it is not productive to improve something the customer did not want initially. By applying QFD in manufacturing will assure to implement the voice of the customer in the final products. Quality Function Deployment helps identifying the new method and technology to perform the operations. This tool provides the basic information to innovation in product and process for future to avoid design errors. QFD is in simply a set of visual key elements in the form of matrixes that are used as the basis for the products development cycle. Quality function Deployment forced to design engineer to concentrate on the customer requirements, so minimise the time in redesign and modifications.

3. PHASES OF QFD PROCESS

There is various application of QFD model based on characteristics and scope in an organization. Models are created as per requirements to analysis and determine the responsible elements for quality. There are four phases in QFD process.

Phase 1, Product Planning:

The primary step is to determine the student's requirements which are both tangible and non-tangible. These are determined by a variety of methods such as previously stored and carried out the market survey. Through these operations the organization is able to identify specifications of quality product. Phase 1 is also called The House of Quality. Business companies and institutes only get through this phase of a QFD process. This first Phase documents customer needs guaranties and warranty data, competitive opportunities, product measurements, competing product measures, and the technical ability of the organization to meet each customer requirement. Getting good data from the customer in Phase 1 is critical to the success of the entire QFD process.

Phase 2, Product Design:

This second phase is initiated from the engineering department. There are various stages of designing the Product/Service. Design requires creativity and innovative team ideas. Product concepts are created during this phase and part specifications are documented. This is the phase where needs to be executed in term of parts designing. Parts that are determined to be most important to meet customer needs in pro-active. This stage requires calculating the various dimensions and factors of safety measures, reliability and quality of work standard. Now a day various software and designing tools being used for example AutoCAD, pro-e, idea etc. After complete part designing and part programming deployed into process planning.

Phase 3, Process Planning:

In this stage actual production of product took place. Manufacturing engineering department plan the whole operation schedule and sequencing the machine tools. The relationship between the component parts is identified and their respective process operations are employed. Process planning is based on flowchart and process parameters.

Phase 4, Process Control:

Implementation of production planning being start in this phase. The performance indicators are created to monitor the production process, maintenance schedules, and skills training for operators. And, in this phase decisions are made as to which process poses the most risk and controls are put in place to prevent failures. The quality assurance department is make continuous concerned to make corrective actions.

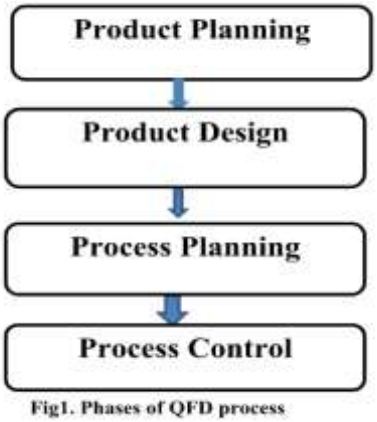


Fig1. Phases of QFD process

4. HOUSE OF QUALITY

Quality Function Deployment is a method to betterment of manufacturing process and quality of products that satisfy the customer requirements. QFD identify the key elements to accomplish these targets through the use of a design tool that is known as the "House of Quality" (HOQ) as shown in Figure 2 Shows that the House of Quality the "Whats" represents the voice of the customer and on the right is a customer competitive assessment that is expressed in form of a rating. The "Hows" indicates the Technical requirements (Descriptors) of a product/ Service and that's means to fulfil the customer needs. The roof is the correlation matrix which shows the inter relationship between the technical requirements. The positive sign shows both the technical requirements effective for quality improvement. The negative sign shows the adverse effect to implements. Than the product performance will satisfy customers is calculated and is expressed as an absolute score and a score that is relative to the target.

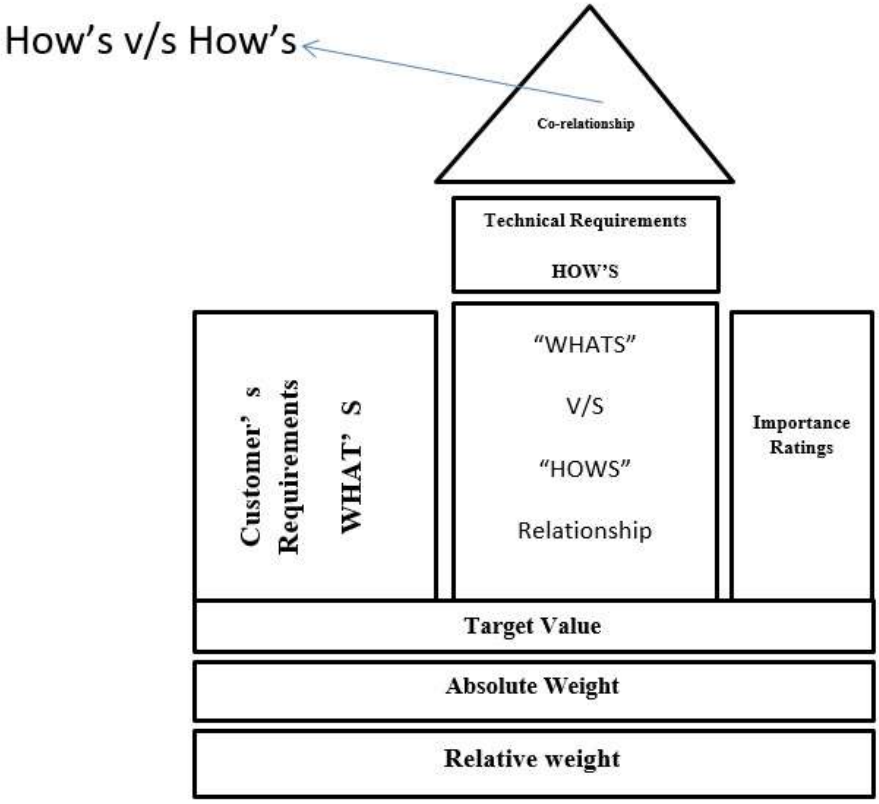


Fig2. House of Quality

5. METHODOLOGY

Quality function deployment technique is applied in a diploma level technical education. This is the case study for finding the factors which are to be concentrate for quality improvement. Following steps are used for collecting the data and its analysis.

5.1 Quality attributes for student's requirements

Two types of questionnaire prepared one for major factors which indicates macro level student's needs. Main need is Teaching Learning Process Infrastructure facilities, Examination and Evaluation, Multimedia Aids, Industrial Exposure, Design of Curriculum, Social & Cultural Activities. Second questionnaire for micro level needs as described in relationship matrix table.

5.2 Development of Technical requirements

Technical descriptors are the means to fulfil the student's requirements. There are various key elements in an educational institute such as Teaching- Learning Method, Lab & Workshop Support and Using Multimedia aids, Financial Supports, Industrial Visit, Inspection & Monitoring, Hostel Facilities and Evaluation System etc.

5.3 Data Collection

The questionnaires were distributed to students and faculty of institute. Students were told to rate the needs as 1for very poor, 2 for low, 3 for medium, 4 for high and 5 for very high, 0 for not applicable. Similarly, the questionnaires for faculty members were also distributed and they were also asked to rate as per the degree of importance as student.

5.4 Construction of House of Quality

House of quality is constructed using student's requirements (Macro Level) (WHATs) and technical requirements as Faculty member's feedback (HOWs). Matrix & correlation matrix is marked by assigning the weight-age according to the relation between the attributes. If there is no relationship then the value assigned is 0, and left blank.

5.4.1 Importance to customer:

A focus group ranks each customer (students) requirements by assigning it a rating as the above degree of 1 through 5. In other words, the more important the student's requirements, the higher are the rating.

5.4.2 Performance of institute:

This is the value assigned by the students to measure the present condition of institute to fulfil the student's requirements.

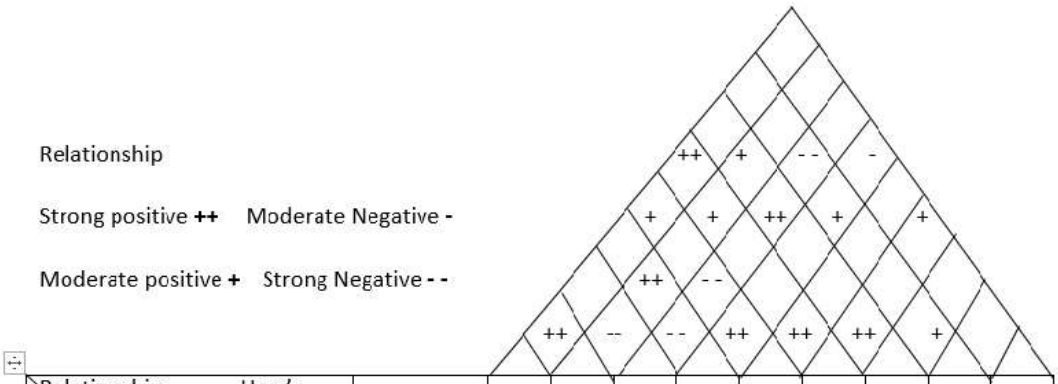
5.4.3 Absolute weight:

The absolute weight is calculated by multiplying the importance to customer to the weight assigned to Relationship matrix

Absolute weight = Importance to customer *(Σ weight assigned to Relationship matrix)

5.4.3 The rating of Relationship

For Very Strong relationship (● value = 9)
For Medium relationship (○ Value = 5)
For Weak relationship (Δ Value = 1)



Relationship How's / What's ● Strong (9) ○ Medium(5) Δ Weak (1)	Performance of institute	Importance to students	Infrastructure	Lab and Research Facility	Amount of Non- Technical Work Assigned	Teaching Load Distribution	Student' s Evolution	Reponses of students	Teacher-Student Interaction	Supporting Staff Availability	Industrial Visit
Teaching Learning Process	3.07	4.41	●	●	Δ	●	○	●	●	●	●
Infrastructure facilities	2.69	4.34	●	○					Δ		
Multimedia Aids	2.27	4.18		●		○				○	
Examination and Evaluation	3.39	4.37			●		●	○	○		Δ
Design of Curriculum	2.71	4.21	Δ	●	○	●	○	○	○	Δ	●
Industrial Exposure	3.05	4.41		●			○	●	Δ		●
Social & Cultural Activities	3.25	4.26	○		○			●	○	○	○
Target Value			5	5	4	4	5	5	5	5	4
Absolute Weight			105	176	85	98	104	161	116	86	143
Relative weight			5	1	9	7	6	2	4	8	3

Fig3. House of Quality

5.4.4 Results for the major student's needs and teaching techniques

It is observed from house of quality for the teaching techniques that Laboratory and Research facility is the most effective technique. It should be given emphasize to developments of laboratory and conduction of practical classes. The second most important teaching technique is Responses of students. All the stakeholders should make efforts for awareness of students. The third technique is industrial visit which demands focus. Industrial visit and training provides demo of theoretical knowledge. It's gives technical and industrial exposer. Similarly, other factors as indicated should be concentrating for effective quality improvements.

5.5 Develop a relationship matrix between WHATs and HOWs:

In this step building a relationship matrix between 28 micro level student's needs (What's) and 9 other technical descriptors (How's). This Relationship matrix is to use to priorities the student needs and the teaching techniques. Authors attempt to find the more teaching techniques and determine their respective relationships. Determining the relationships between the student needs and the technical requirement may be confusing. Each requirement may affect others. Therefore, the relationship is divided into three categories – strong, medium and weak relationship.

S. No.	Relationship How's ● Strong (9) ○ Medium (5) Δ Weak (1) What's	Performance of Institute	Importance to students	Teaching- Learning Method	Lab & Workshop Support	Using Multimedia aids	Financial Supports	Industrial Visit	Inspection & Monitoring	Design of Curriculum	Hostel Facilities	Evaluation System
01	Laboratory facilities	3.16	4.21	●	●		●		○	●		Δ
02.	Workshop facilities	3.26	4.16	●	●			○		●		
03.	Teaching aids(ex LCD	2.63	4.21	●	●	●				○		
04.	Availability of scholarship	4.16	4.68	○			●					
05.	Exam system	4.05	4.74	Δ	Δ					○		●
06.	Course duration	2.95	4.16	○	○		○	●	○	●	●	○
07.	Library facilities	3.21	4.32	●						○		
08.	Continuous assessment	3.00	4.11	Δ					●	●		●
09.	Hostel facilities	3.26	4.47	○	Δ	Δ	○		○		●	
10.	Remedial Class for week	3.47	4.05	●	○		○		○	Δ		Δ
11.	Problem solving project	2.84	4.47	●	○	○	Δ			Δ		
12.	Group Discussion	2.79	4.11	○					○			
13.	Technical quiz	3.11	4.26	○								Δ
14.	Games and Sports	3.16	4.05									
15.	Cultural Activities	2.89	4.21									
16.	A good qualified teacher	3.53	4.42	●	●	○			○			
17.	Sincerity of a teacher	3.37	4.42	●	●	○			○			
18.	Regularity of a teacher	3.16	4.68	●	○				○			
19.	Technology Exposer	2.47	4.26	○	○			●		Δ		
20.	Seminar hall/Conference	3.11	4.32	○								
21.	Back up facilities for	2.47	4.05	○								
22.	Usages of Internet	1.42	4.16	○								
23.	Computer facilities	2.11	4.53	○	○	○				○		
24.	Interactive website	2.37	4.16	○	○	○						
25.	Usage of learning Software	2.47	4.32	●	●	○				Δ		
26.	Industrial Attachment	1.68	4.26	●				●				
27.	Arrangement of job fair	1.84	4.26				○					
28.	Industrial Visit	2.58	4.79	●				●				
	Target Value			**5**	**5**	**4**	**5**	**5**	**5**	**5**	**5**	**4**
	Absolute Weight			**715**	**392**	**174**	**171**	**178**	**210**	**255**	**78**	**110**
	Relative Weight			**1**	**2**	**6**	**7**	**5**	**4**	**3**	**9**	**8**

5.4.4 Result for the major student's needs and teaching techniques

The above matrix indicated that teaching technique Teaching-learning method given highest priority. Second factor is Lab& Workshop support which develops the various engineering skills. Third factors Design of Curriculum. Curriculum is knowledge base for various theoretical and practical. Forth factor is inspection and monitoring. For improvement in quality of education continuous needed to observation. Similarly, other teaching techniques should be focused for effective quality improvements.

6. CONCLUSION

Ultimately the importance of technical education at diploma level is universally accepted. Technical institutions in developing country like India are required to provide the skilled men power to industries and market. Technical knowledge serves the nation and thus strengthening the economy of the country. In changing environment of market and industries requires variety of product and service. Therefore, quality function deployment tools keeps the industries and institute aware with a change in demands. Quality function deployment supports the technical institute to understand Students needs and teaching techniques. This research shows that teaching techniques should be implemented with positive efforts for improve the quality of technical education in polytechnic college. Enhance to produce skilled manpower in sufficient numbers to meet the needs of the industries. To capitalized the economy of our country.

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