

Application of TQFD – A Case study for Performance & Quality Improvement in Engineering Institutions in Chhattisgarh

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Abstract— The paper is based on a methodology that can be used to analyze and improve existing products or to even develop any new products. This methodology has been successfully implemented for process and design improvement in many manufacturing and service sectors. An attempt has been made to implement QFD to design House of Quality (HOQ) for Technical Education System (TES). In this method, customer needs are transformed into technical design characteristics by linking all the stakeholders of TES. By integrating VsOC into technical characteristics better products can be produced according to customer satisfaction.. This provides an insight into the customer preferences and technical requirements. The respondents included faculty/administrators, students, parents and recruiters of engineering institutions.

Index Terms— Total Quality Management (TQM), Quality Function Deployment (QFD), Total Quality Management (TQFD), Voice of Customer (VsOC), House of Quality (HOQ), TES- Technical Education System, Customer-Technical Interaction (CTI), Normalized Customer-Technical Interaction (NCTI),

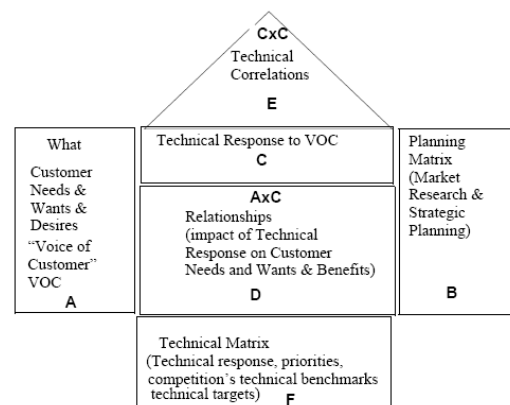
1 INTRODUCTION

In the midst of striving for industrial development, economic growth and business globalization, it is vital that engineering educational institutions adopt the concept of quality [9]. Although all universities have been teaching the concept of quality [8], most institutions have not widely adopted or practiced what they teach in their operations. Engineering Education worldwide has encountered many challenges in recent years. A rapid development of new technology and information network requires engineers and technologists to face new situations in their working environments all the time. This TQM revolution resulted in the installation of quality systems in the organizations of varied types and sizes in the form of ISO 9000 certification. Quality Function Deployment (QFD) is one of the Total Quality Management (TQM) used as a measurement of quality. Fig-1 represents HOQ in QFD. In recent times, due to globalization of national economics, privatization efforts are being made even in the educational sector to meet the current and expected demands. Student customers are dissatisfied, when the services do not meet these assumed expectations.

When the institutions provides services of quality at economic cost and consistently meet the customers' needs then the organization is said to have satisfied the customer.

2 LITERATURE REVIEW

Even today, the trend of ISO 9001 (latest version) certification is still unabatedly growing in the modern world [3,5, 13]. These developments lead to the impression that TQM principles are devoid of pitfalls and deficiencies. However this is not completely true. There are many researchers and practitioners who have pointed out certain in-capabilities of TQM [10, 11, 12]. In order to overcome these in-capabilities, a number of improved and refined models of TQM appeared [2]. Some of them are sustaining and some of them are not. Besides some tools like Cause and Effect diagram and Pareto analysis became very popular among researchers and practitioners' [7]. Further a few quality awards also accompanied the TQM movement [1].



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Fig. 1: The House of Quality-The QFD diagram

Using 'Total Quality Function Deployment' (TQFD), an attempt has been made to provide a general framework for designing the service instrument suiting the stakeholders of engineering educational institutions. The research was motivated due to the fact that Chhattisgarh is generally perceived as a tribal dominated state.

The success of TQM in the manufacturing sector has opened the possibilities of its application in technical education. The education delivery process with its own inputs and outputs can be subjected to TQM principles. Many Institutions and Universities in foreign countries have started TQM. As on-date it is said that about 200 Institutions of higher learning are involved in TQM throughout USA and many more in other countries. The innumerable contributions made by quality gurus to the field of TQM make it a very effective philosophy and its application to education in general and technical education in particular will lead to continuous quality improvement. The increasing popularity of TQM was accompanied by the evolution of techniques like Quality Circle (QC), Failure Mode and Effect Analysis (FMEA), Benchmarking and Quality Function Deployment (QFD).

3. METHODOLOGY

The study is confined to engineering institutions in Chhattisgarh state imparting graduate degrees. The communication media would include personal contact, e-mail and postal methods. Another aspect of totality of TQFD is that, when customers' reactions are considered for subsequent studies, the technical language pertaining to all parameters is to be developed.

3.1 Framework of TQFD Technique

The conceptual features of TQFD are depicted in Figure 2. The steps of TQFD and the activities carried out under them are described in the following subsections.

3.2 Objectives of the study

- Identify the customer needs
- Prioritize these needs
- Address these needs at operational level
- Identify the design characteristics of a system that would meet the customer requirements of the various stakeholders.
- Prioritize these design characteristics.
- Plan out the action plans for the prioritized customer needs.
- Develop a framework of the system design requirements based prioritized design characteristics.
- The application of the adopted TQFD was in the design of the overall assessment of the engineering educational institutions in India.

3.3 Identification of Customers/ stakeholders

As the first step, the concept of TQM is to identify the customers of the organization under survey. So here, four types of stakeholders of TES were identified as follows:

- Faculty/ administrators – internal customers
- Students – internal customers
- Parents – external customers
- Recruiters – external customers

3.4 Identification of Critical Parameters

For the four types of stakeholders, the requirements and necessities differ. Keeping this in mind, critical parameters for the different stakeholders were identified through literature review and discussions with experts in the field.

3.5 Data Collection

3.5.1 Development of Questionnaires

Initially a pilot study is conducted to identify the customers' voice. Based on the pilot study, TQFD technique is applied. For the pilot study as well as for TQFD implementation the following procedure is followed. During this research work, engineering educational stakeholders' voice is gathered from the point of view of the current perception.

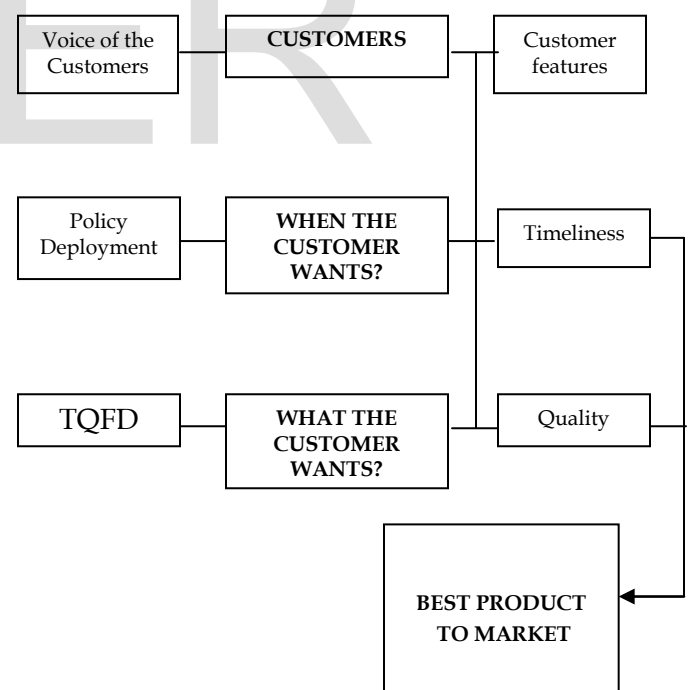


Fig.2: Conceptual Feature of TQFD

3.5.1 Sampling Technique

For the pilot study, questionnaires are sent to 50 respondents of each type of stakeholders, and the questionnaires found to be completed are utilized in TQFD technique. For TQFD develop-

ment, the valid and reliable questionnaires are distributed to faculty/ administrator, students, parents and recruiters.

The scale used is a five-point Likert scale ranging from strongly agree to no opinion (valued from 1 for “strongly disagree/no opinion/no idea” to 5 for “strongly agree”). The statistical method is used to calculate the weighted average score of the VsOC to obtain the importance ratings of the various VsOC and is entered in the QFD matrix.

Formula

Weighted Average = No. of (Strongly agree reactionsx5 + Agree reactionsx4 + Moderately Agreex3 + Disagree reactionsx2 + No idea reactionsx1) x 100 / (Total no. of respondents considered x Maximum value of the weightings assigned considering the quality aspects).....(1)

3.6 Implementation of the TQFD technique

The TQFD technique makes use of charts and matrices. The key steps explained above in the methodology in furnishing the House of Quality (HOQ) are as follows:

3.6.1 What's: Voices of Customer

The first step is to gather the Voices of Customers (VsOC). Prior to gathering VsOC is to identify the stakeholders of TES. The VsOC is first obtained through discussions with experts. Qualitative validity was tested through theoretical study as well as through expert comments. Quantitative validity is tested through an exploratory weighted average score of value greater than 0.6. The customer requirements is then finalized and grouped into four categories i.e. faculty/ administrators perspective, students perspective, parents perspective and industry perspective. The relative score is then ranked depending on the score obtained through the analysis.SPSS is also used to conduct quantitative validity through factor analysis and to test for internal consistency and reliability of the questionnaires, the overall coefficient alpha (Cronbach's) for the entire sample is calculated.

There after the QFD matrix is developed separately for each stakeholders wherein the relationship between the customer requirements and design characteristics are generated through experts.

3.6.2 Hows: Technical Characteristics/Design Elements

The VsOC is then translated into technical characteristics. These can be further quantified whenever necessary. The HOWs will constitute many of the action agendas in the strategic plan [6].

3.6.3 Relationship Matrix

In this application, those having very strong relation are represented by nine points, moderately strong as three points, weak relation is represented by one point and no relation is left as empty cell. With the interrelationship matrix furnished, the

weighted average score for each of the VsOC and column weights of each design elements is computed. The weighted average score obtained is then used to rank the various VsOC [14] and the design elements is ranked based on the relative scales computed. Thus the VsOC and the customer-technical interactive (CTI) score are prioritized.

3.6.4 Customer – Technical Interactive Calculation

Formula

CTI score

= \sum relationship values between customer voice & technical element x expected value of customer voice.....(2)

Inorder to visualize the relative weightings, the percentage normalized values of Customer Technical interactive (NCTI)score are computed as follows

Formula

Percentage NCTI score =

(CTI score / Sum of CTI score) X 100.....(3)

3.6.4 Correlation Matrix

The correlation matrix forms the ‘roof’ of the HOQ. Each of the design elements are examined against each of the rest [4]. The correlation between each pair of design elements is expressed as very strong, moderately strong, weak and no relation. Empty cells represent the fact that no known correlation exists between the pairs. After the development of interrelationship matrix in the HOQ, the relative scale is computed. The design elements in the roof are ranked based on the relative scale computed.

3.6.5 Implementation Assessment

To assess the competitive position, the survey also incorporates an implementation assessment section through experts. The design elements thus prioritized based on the relative scale is distributed to the experts. To assess the possibility of implementing them, a three point Likert scale ranging from 0-10 is considered. The scale incorporated ‘completely possible’, ‘partially possible’ and ‘not possible’.

4 RESULT ANALYSIS

Two software packages – Microsoft excel and SPSS-16.0 version is used for the analysis. For the pilot study as well as for TQFD analysis, the datas collected from different stakeholders is tested for validity and reliability. After data analysis, the datas is used in to build the House of Quality (HOQ) using QFD technique.

5 CONCLUSION

The literature survey conducted during this research favored the development of a method for analyzing the performance

measurement for the engineering colleges. The TQFD technique can be used to develop a framework for system design characteristics of technical educational institutions in India. The theoretical features for this model are presented here by citing references for establishing the rationales of the steps encompassed in it.

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