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FLEXIBLE SYSTEMS METHODOLOGY APPROACH FOR TQM IMPLEMENTATION IN INDUSTRY

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ABSTRACT

Total quality Management has assumed a great importance in today's highly competitive manufacturing industry. TQM has been widely implemented throughout the world. Many firms have arrived at the conclusion that effective TQM implementation can improve their competitive abilities and provide strategic advantages in the marketplace. There are many approaches used for implementation of TQM in industry. All approaches include division of tasks into subtasks, addressing the human and social aspects of implementation and starting from education of the top management. It is, however, observed that there is a great degree of diversity within the organizations with regard to products, processes, types of resources used, education level and background of employees and so on. Therefore it is recommended to use a flexible approach for implementation, which takes into account the factors and forces prevalent in industry. The paper presents a study using Flexible Systems Methodology for implementation of TQM in manufacturing industry. The evolved framework involves the management of industrial 'situation' by the 'actor' (industrial unit) through a management 'process' in a flexible manner; actor, situation, process being the three inseparable components of flexibility.

Keywords: *Flexible Systems Methodology (FSM), Flexibility, Total Quality Management (TQM), Actor, Situation, Process, Critical Success factors.*

Introduction

Liberalization and globalization has brought an enormous change in the Indian markets. The market has really turned into a buyer's market. Many models of products are now available and the customer has become a king. High quality products are available off the shelf at reduced prices. New and improved products are entering the market at a very fast rate, lead times have become smaller and product life cycles have also become very short. While the customer has been benefited a great deal from this paradigm shift in the market, the manufacturer is facing an unprecedented level of competition and pressure to contain the price of products. The price of the product is now set in the market. Pressure on the small manufacturer has been added up because of demand of bigger companies to cut the prices of components supplied, small

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volumes of each type of products to be made, leveled pull and compulsion to shift the finish operations near the bigger company. In such a scenario it is essential for the organizations to cut cost and improve quality. Producing everything right the first time every time is very important. Total Quality Management (TQM) thus assumes a great importance in the prevailing manufacturing scenario.

Quality has many connotations; Fitness for Use, Conformance to specifications, long life, aesthetics, large number of features, ease of use and so on. Quality, however, can be defined comprehensively as the totality of features and characteristics of an entity (product and service) that bear on its ability to satisfy the customers' stated or implied needs. In the present context Quality can also be defined as, "Quality is to continuously catch the voice of customers (his future needs, which even he has not realized), convert it into a product or service and make it available to him at a price less than that of the competitors and in the time duration smaller than that of the competitors". For achieving quality in today's competitive market every stage of production activity has to be properly planned, organized and controlled. Care has to be taken at all stages starting from product development to its design, manufacture and delivery to customers. All functions viz human resources, materials, engineering, marketing, production, quality control need to be involved. All levels of management and all stake holders need to take steps to achieve and maintain quality in their domain of work. TQM has three essentials; total commitment from the top management, total involvement of all employees and stake holders and use of scientific knowledge, tools and techniques. Following definition of TQM explains the integration of above three essentials.

"Total Quality management is a culture; inherent in this culture is a total commitment to quality and an attitude expressed by everybody's involvement in the process of continuous improvement of products and services through the use of innovative scientific methods". As explained above TQM is not a step-by-step technique but it is a culture. This culture varies from company to company. Implementation of TQM in an organization would demand designing a procedure taking into account the factors and forces prevalent in that organization. This demands that a Flexible approach is used for implementation of TQM.

The concept of flexibility in an organizational context refers to the ability to precipitate intentional changes, to continuously respond to unanticipated changes and to adjust to the unexpected consequences of predictable changes (Bahrami, 1992). Flexibility is also defined as the ability to change or react with little penalty in time, effort, cost or performance (Upton, 1994). The concept of flexibility dwells on three central issues of continuum, freedom of choice and dynamic interplay, which are highly interrelated.

The three basic components that define the dynamic interplay of reality in flexible system management paradigm are situation, actor and process. The situation is to be managed by an 'Actor' through a flexibly evolved management process. Flexible Systems Methodology bridges the gap between hard system based techniques and soft system based techniques (Singh et al, 1996).

The paper presents a study using Flexible Systems Methodology for implementation of TQM in manufacturing industry. The work is carried out in four phases. The first phase involves 'Clarifying the Context', through detailed review of existing literature on various aspects of TQM, its implementation, flexible systems methodology and its applications.

The second phase of the work 'Understanding the Situation' involves a survey of various industrial organizations with regard to the level of implementation of TQM, efforts made, strategies used, results obtained, problems faced and so on.

The third phase 'Assessing the Actor's Capability' involves conducting detailed case studies in some of the surveyed organizations for finding out more details about the process followed, problems faced etc with an aim to establish the capability of the organization to achieve TQM implementation.

Phase four of the study aims at 'Evolving a management Process' for TQM Implementation which is specific to the class and category of the industry. This phase takes into account, the information collected in all the previous phases and its analysis in the light of expert opinion to evolve a management process.

Phase I: Clarifying the Context

It involves detailed study of areas and aspects related to TQM, its CSF's (Critical Success Factors) and need of TQM implementation in Indian Manufacturing Industry. An extensive literature survey has been carried out to answer above-mentioned needs. The study includes review of fourteen different frameworks developed by researchers viz. Deming Prize (2004), MBNQA (2004), EQA (2004), Saraph et al (1989), Oakland (1993), Flynn et al (1994), Babbar et al (1994), Ahire et al (1996), Black et al (1996), Pheng et al (1996), Zhang et al (2000), Nwabueze (2001), Thiagarajan et al (2001). In particular the reference was made to a Chinese study on 'Quality management approach in China" by 'Zhihai Zhang'. Zhang has proposed four Critical Success Factors (CSF's) of Overall Business Performance and 11 CSF's of TQM. He has also given a model of TQM implementation and also analyzed the effect of TQM implementation on Overall Business Performance. Various constructs given by Zhang in above-mentioned study are:

1. Leadership
2. Supplier Quality Management
3. Vision and Plan Statement
4. Evaluation
5. Process Control and Improvement
6. Product Design
7. Quality System Improvement
8. Employee Participation
9. Recognition and Reward
10. Education and Training
11. Customer Focus

The study of above-mentioned framework has been made the basis for the current study and from this framework, Critical Success Factors relevant to Indian Manufacturing industry have been chosen. This phase also builds a clear understanding of flexibility and flexible system methodology.

Several authors had conducted various studies on TQM implementation and other allied areas in Indian Industry but FSM was never made basis of a strategy for TQM implementation.

Phase II: Understanding and Assessing the Situation

In this phase a detailed survey of manufacturing Industrial units in Punjab (India) was conducted. The survey depicts the 'Situation' with regard to following points:

1. Do manufacturing industries in India adopt TQM?

2. Up to what extent manufacturing industries are implementing various CSF's of TQM?
3. Process of implementing TQM in the company
4. Difficulties faced in the implementation process
5. Extent of success achieved in TQM implementation.
6. Effect of TQM implementation on other areas.

To collect information from industry on the above aspects a questionnaire was specifically designed and pre-tested on a representative population of industrial organizations. In this questionnaire, questions were prepared on various topics related to following ten broad areas of TQM:

1. Top Management Commitment and Participation
2. Supplier quality management
3. Vision, Mission, Quality Policy & objectives
4. Analysis of Data & management Review
5. Process Control & Improvement
6. Customer related Processes and Product Design
7. Implementation of quality System
8. Participation of Employees
9. Recognition & rewards
10. Education & Training

For each question a scale of 1-5 was made. At least five questions were framed on each of the above ten broad areas.

The questionnaire was sent to the organisations by mail. Personal visits were also undertaken wherever necessary. Out of 50 organisations chosen for the survey 31 provided the requisite and complete information. The raw score received from the industry was statically analysed to find out the status of each area of TQM in the organisation as also the standing of an industry with regard to all areas of TQM taken together

Table 1 represents the status of each broad area of TQM in all the surveyed units taken together as well as the variation amongst them with regard to status of each area. This is represented by standard deviation.

The second column of the table shows various Critical Success Factors. These CSF's are represented by a number of sub areas. The questionnaire contains at least five questions on

Table 1: Status of Various Broad Areas of TQM

S No	Critical success Factor	No. of Sub Factors in Questionnaire	Attained Score (in %)	Standard Deviation
1	Top Management Commitment and Participation	8	50	4
2	Supplier quality management	6	45	4.5
3	Vision, Mission, Quality Policy & objectives	8	55	3.8
4	Analysis of Data & management Review	10	42	5
5	Process Control & Improvement	8	58	4.3
6	Customer related Processes and Product Design	14	60	3.2
7	Implementation of quality System	5	68	3.1
8	Participation of Employees	8	65	3.0
9	Recognition & rewards	6	55	3.3
10	Education & Training	6	60	2.8

each of the sub areas. Column 3 shows the number of sub areas contained in each CSF. Since the scale for each question awards one, two three, four or five marks to a question depending upon the status of each aspect of the organization, the total score of an aspect in all companies taken together can be worked out by the following formula.

$$S_a = \frac{\sum S_i \times nj}{N}$$

Where

Si is the score of a company in a sub area (i varies form 1 to 5)

Nj is the number of companies securing that score,

Where $\sum j = N$, total number of companies.

The above score of each sub area has been converted to the percentage score as under:

$$\text{Percentage score} = \frac{\sum Sa_i}{nSm} \times 100$$

Where Sa_i is the average score of a sub area under a CSF, n, the number of sub area in a CSF and Sm is the maximum score a sub area can achieved i.e. 5.

The data of average scores contained in Table 1 is also represented in the form of a histogram shown in figure 1. The figure depicts that the CSF which gets the maximum score of 68% taken together is "Implementation of quality systems" followed by "Participation of employees (65%)". There are two more CSFs which get a score of 60%. They are "Customer related Processes and Product Design" and "Education & Training'.

Two CSFs that is "Analysis of Data & management Review" and "Supplier quality management" get a score of 42% and 45%, thus showing their poor status in the industry. All other aspects are shown to be at an average level getting a score of less than 60%

Further the Standard Deviation of these CSF's, as shown in Figure 2, represents that there

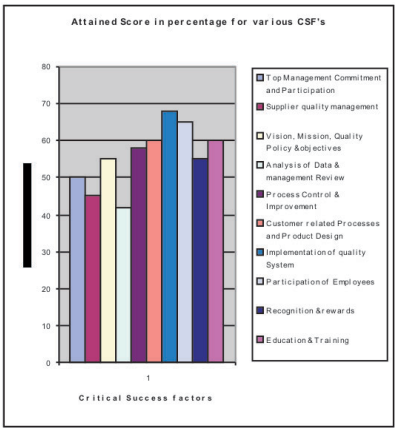

Figure 1: Average Score of each Aspect

is a large variation between the performance of companies with regard to "Analysis of Data and Management Review (SD 5)", "Supplier quality management (SD 4.5)" and "Process, Control and Improvement (SD 4.3)"

Out of these three aspects two aspects "Supplier quality management (45%)" and "Analysis of Data and Management Review (42%)" also have a poor score. This represents that very few companies concentrate on these two CSF's amongst the organizations. The third aspect i.e. "Process, Control and Improvement" has otherwise a reasonable score (58%) but the variation amongst the organization is large representing that some companies are doing well while the others are poor.

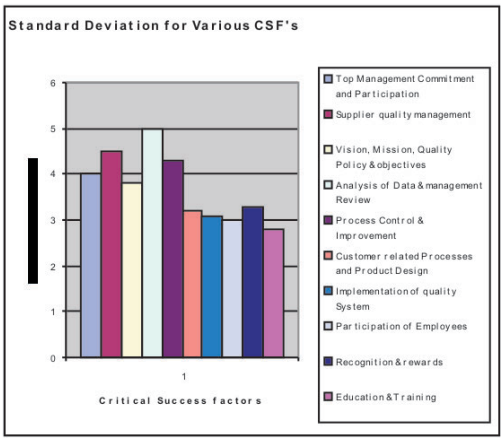

Figure 2: Standard Deviation of Various CSFs

Status of three Axioms of TQM

As explained earlier the three essentials (Axioms) of TQM are; commitment from the top management, involvement of all employees and stakeholders and use of scientific method, tools and techniques. From the status of various CSF's of TQM, the tsatus of three axioms of TQM have been calculated. Details of various CSF's under each axiom and the computation of scores are given below:

1. **Commitment of Top Management**
   - a) Top management Commitment =50%
   - b) Vision, Mission, Quality Policy & objectives =55%
   - c) Analysis of data & Management review =42%
   - **Overall score (Average) =49%**
2. **Involvement of all Employees**
   - a) Participation of Employees =65%
   - b) Recognition & Rewards =55%
   - c) Education & training =60%
   - **Overall score (Average) =60%**
3. **Use of Scientific Methods**
   - a) Supplier Quality management =45%

b) Process Control & Improvement	=58%
c) Customer related processes & Product Design	=60%
d) Implementation of Quality system	=68%
Overall score (Average)	**=58%**

This data depicts that manufacturing industries in region have paid reasonable amount of attention on the second Axiom of TQM i.e. involvement of all employees, which gets a score of 60%, followed by use of scientific methods (58%), while they lack in top management commitment which gets a score of 49%.

Status of Industrial Units with Regard to TQM Implementation

From the raw scores collected from the industry on each sub areas contained in the questionnaire the total score of a company in all the aspects taken together was calculated. From these scores the status of each company was worked out.

Figure 3 is a Scatter Diagram, which shows the status of all the 31 organizations in TQM implementation. Along X-axis is shown the company number, and on Y-axis the score of that company in context of TQM implementation taking together score of all CSF's.

Further from the total scores of the companies average and standard deviations were calculated as 55 and 10.27. The companies were put into various categories based on the stipulations of the normal distribution curve. The details are:

Excellent	Above Average + 2 s
Very good	Between Avg + 1s and Avg + 2s
Good	Between Avg and Avg + 1 s
Poor	Below average

In Figure-3 three lines have been drawn at the cut off points of above categories. Pie chart of figure 4 shows the percentage of companies in each of these ranges.

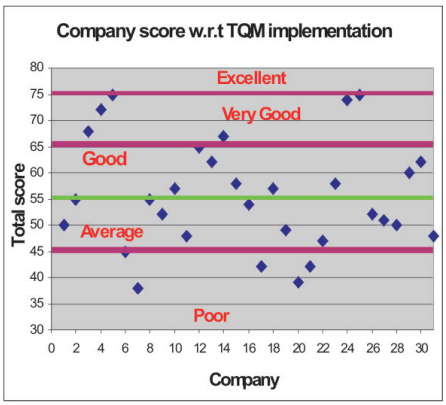

Figure 3

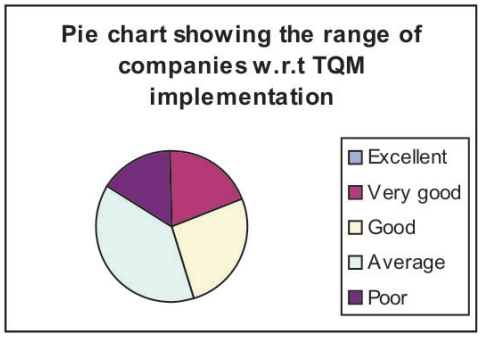

Figure 4

The diagram shows that no organization is in the excellent range, only 19 % are in very good range, 26 % are in good range and the remaining 55 % are in average or poor range. The data depicts that efforts need to be made immediately to upgrade the companies in the average and poor ranges to the levels at which others are.

Phase III: Assessing the Actors Capability

In this phase of the work, detailed case studies were conducted in two organizations. The organizations were selected based on their status found out in phase II of the work. One organization was from the category of very good from TQM status point of view, while the other from poor category.

In the case study, data regarding initiatives taken by the organization with regard to various aspects of TQM implementation was collected and arranged in a chronological order. A SAP-LAP Analysis was carried out. Here, in this paper only the major learning are presented which are as under:

1. The successful organizations started with the training of the top management while in unsuccessful organizations the top did not bother much and left the learning to middle and lower level people.
2. In successful organizations data generated is analyzed while in unsuccessful organizations the data maintenance and analysis is not done properly.
3. Vision, Mission and Quality Policy statements are available but a mechanism to achieve these has not been found in place, particularly in unsuccessful organization.
4. Education and Training has been started everywhere but in unsuccessful organizations the exercise is not fully structured. Feedback of training is not properly taken and made use off.
5. In both kinds of organizations, the employees have become quite keen to participate but in unsuccessful organizations, not much of participation is sought by the management as good communication from top to bottom does not exist.
6. Recognition and reward system existed, to some extent, in successful organizations while it was totally absent in unsuccessful organizations.
7. State of process control was found to be poor in unsuccessful organizations while in successful organization, some efforts were seen in this direction.
8. Emphasis on 'Quality at source' was found to be poor in general.
9. Efforts being made at determining the customer requirements and bringing them into product designs were found to be at a reasonable level in both types of organizations.
10. Implementation of Quality Systems was also found to be good.

Phase IV: Evolving a Management Process

Based on the findings of the previous phases a broad strategy made for implementation of TQM in industry has the following steps:

1. Top management education
2. Education of all employees and stake holder.
3. Preparation of Vision, Mission, Quality Policy, Long and Short-term objectives and strategies to achieve these goals.
4. Seeking acceptance of all the employees on Vision, Mission, Quality Policy and Strategy.
5. Addressing the employee related issues.
6. Implementation of ISO 9000:2000 in letter and spirit.
7. Changing systems and standardizing them. Employing Method Study and taking care of the ergonomic aspect.

8. Bringing in technology changes and automation where ever possible.
9. Making Structural changes to suit changes made in technology and systems.
10. Implementing PDCA (Plan, Do, Check and Act) and making Continuous improvement.
11. Instituting Suggestion Scheme and rewarding good suggestions.
12. Ensuring quality at source by concentrating on supplier's Quality Management System.
13. Extensively using statistical techniques in analysis of data and process control.

The above strategy is evolved in a step-by-step manner but it is observed that some of these steps are to be employed on a continuous basis going from preliminary to intense application.

Conclusions

The application of Flexible System Methodology on an important aspect of implementation of TQM has been attempted in this paper. Many strategies have appeared in the literature for the implementation of TQM. However, it is felt that the strategy should take into account the factors and forces prevalent in a region and in the class of industry where TQM is to be implemented. The study reported in this paper has amply demonstrated the power of Flexible System Methodology to make TQM implementation process effective and reliable.

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