THE APPLICATION OF THE TOTAL QUALITY MANAGEMENT IMPLEMENTATION METHODOLOGY

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Abstract:

Considering quality is essential for successful innovation'. - Increasing true as a result of the increasing speed of new product development, and because a product design is likely to be manufactured multinationals. Quality and cost are complementary, not conflicting business objectives'. Good quality fundamentals lead to good resource utilization; and hence to good Productivity and low quality costs. This paper makes an attempt to illustrate the application of the Total Quality management Implementation methodology.

Index Terms: *Quality, Management, Product management, total quality management; organisational characteristics.*

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I. INTRODUCTION

Managing total quality, in recent years, has taken a different meaning as is evident by numerous articles published on the subject of total quality management (TQM). TQM is looked on as a process-oriented of enhancing customer satisfaction through the production of higher quality goods and services.

Different organizations use different methodologies, approaches and tools for implementing a quality management and programmes for continuous quality improvement. The programme is likely to have a different name or label, such as TQM (Total Quality Management), Six Sigma, BPR (Business Process Re-engineering), Operational Excellence or Business -Excellence. Quality assurance is important in the engineering and construction industry.

A baseline technical definition of what TQM is all about has been given by the American Federal Office of Management Budget Circular (cited in Milakovich, 1990, p. 209), "TQM is a total organizational approach for meeting customer needs and expectations that involves all managers and employees in using quantitative methods to improve continuously the organisation's processes, products and services." *Alexandros G. Psychogios and Constantinos-Vasilios Priporas* 42

In addition, the American Federal Office of Management (cited in Morgan & Murgatroyd, 1997) defines TQM as,

> *…a total organizational approach for meeting customer needs and expectations that involves all managers and employees in using quantitative methods to improve continuously the organization's processes, products, and services.*

According to the latter definition TQM is not merely a technical system. In fact, TQM is associated with the organisation itself, which is also a social system. Pike and Barnes (1996) argue that organizations are not only technical systems, but also human systems. In addition, Oakland (1993) states that TQM is an attempt to improve the whole organisation's competitiveness, effectiveness, and structure. For Dale (1999),

> *TQM is the mutual co-operation of everyone in an organisation and associated business processes to produce products and services, which meet and, hopefully, exceed the needs and expectations of customers. TQM is both a philosophy and a set of management guiding principles for managing an organisation.*

From the above definitions, we can identify two important aspects that comprise TQM: management tools and techniques as well as management concepts and principles. The techniques refer to what has been referred to as the "hard" aspects of TQM, while the principles refer to the "soft" side.

II. TEN MANTRAS FOR TOTAL QUALITY MANAGEMENT

- ✓ Quality is never an accident; it is always the result of untiring and intelligent effort. There has to be the will to produce a quality product.
- ✓ Quality is like a prayer to GOD, which never comes out without hard work and devotion.
- ✓ Quality is every body's business,
- ✓ Quality begins with the cleanliness of the work place.
- ✓ Take care of quality, quantity will take care of itself.
- ✓ Make it right for first time and all times.
- ✓ Quality is achieved through team work.
- ✓ Document is dependable but not the memory.
- ✓ Quality begins and ends with education.
- ✓ Quality is the attribute that a customer uses to evaluate products on services.

III. PHASES OF QUALITY MANAGEMENT

A. Quality Control Phase (QC):

QC focuses on product defect detection through post production inspection. It is concerned with the adherence to standards, through a systematic and rigorous approach and sorting out rejects. The inspector functioned as a sieve, weeding out the defectives at the end of the production cycle. Thus corrective action took place, when waste had already been created

B. *Quality Assurance Phase (QA):*

The process control approach that followed in 1950s, introduced statistical methods to monitor trends and to ensure that only such products which fall within the specified tolerance limits are produced. The reliability movements of mid 1950s shifted the stress from "quality of manufacture" to "quality of design". In late 1950s the term "QA" gained credence, which enlarged the scope of quality to "quality of customer support and quality of administration in addition to quality of

conformance and quality of design". The QA movement had recognized the fact that quality cannot be isolated and its responsibility cannot be assigned to certain small group of individuals known as inspectors, but all departments who have anything to do with the product or service; all of them have a contribution to make.

QA recognizes that "inspection is not the answer" and that the entire manufacturing process must be committed to meeting the quality needs of the design. QA focuses on procedure compliance and product conformity to specifications through production and operation management. QA was a new and a radical approach which considered quality in a company-wide sense emphasizing the point that quality is everyone's responsibility. QA has moved the movement away from inspection into the area of "prevention" and compliance with customer requirements (doing right the first time). It relies on a comprehensive System of planning, documentation, statistical process control (rectification at source) and product certification (approval).

C. Total Quality Control Phase (TQC):

The quality movement has moved its concept from organizational, operational aspects to a strategic position, where emphasis has been put on being Pro-active and building stronger links with customers and suppliers and introducing a philosophy of continuous improvement. The evolution of quality movement has, therefore, been shifted from a role of controlling (inspection, QC) to a role of managing via systems and procedures (QA) and finally to a pro-active role where quality is a board room issue, where it is a culture to be encouraged and adopted, where the customer — supplier chain is the business cycle and where business performance is measured by "added value activities" such as problem solving via continuous improvement programs.

TQC programs attempt to expand the QA philosophy beyond manufacturing operations into other areas of organizational life. TQC incorporates many of the tools used in QA but the purpose of problem analysis is to develop the long term solutions rather than respond to a short term variations. Concern with direct cost reduction and a pre-occupation with efficiency are ousted in favor of the pursuit of quality through elimination of waste and non-value added procedures and assuming continuous improvement through the refinement and expansion of quality control systems and procedures.

D. Total Quality Management Phase

The responsibility for quality does not stop with the quality department but extends to every single individual in the organization. Total quality cannot be effectively achieved without involving

people and this cannot be done without achieving the goal transmission among various groups, departments and levels, and making them work as team. The concept of quality and innovation has to start from the grass routes. But this requires a paradigm shift in the management's view of workers. They need to think strategies to empower and involve workers and give them a stake in the enterprise. The only way to tackle the complexities and problems of modern processes is through the involvement of people and inculcating team spirit.

IV. PRINCIPLES OF QUALITY MANAGEMENT

TQM focuses at two levels. Firstly an "external" one aimed at identifying customer requirements and secondly an "internal" one focusing on organisation, systems and procedures to meet those requirements right the first time and every time. These guiding principles of TQM for ensuring a cohesive and integrated quality functioning of an organisation can be summarised as under.

a) *Customer Orientation.* It is an obsession for both internal and external customers and their needs through regular feedback.

b) *Vision*. Future vision of an organisation leads to directions, values and goals which lift horizons and raise expectations.

c) *Leadership Commitment*. Top down commitment and bottom up initiative. Reduce bureaucracy. Coach the team and support the effort.

d) *Quality Strategy*. This strategy emanates from top. Defect prevention — not inspection i.e. building quality up stream. Leads to strategic goals and plans of action.

e) *Values*. Translate the organisational strategy into thrust areas.

f) *Quality Culture*. Not to sacrifice quality for quantity. Dedication to continuously strive for improvement in all procedures, activities and services. Every employee to strive for professional excellence in own capacity. Constantly work for eliminating all waste.

g) *Employee Empowerment and Participation*. Technology cannot innovate, only people can. Bring about work ethics and attitudinal changes to harness the potential, commitment and involvement of people.

h) *Team Work Approach*. It includes horizontal (Break barriers between departments), vertical (reduce layers), cross functional (encourage cross functional teams) approaches.

i) *Communication*. Two way, clear, consistent and forceful. Essential for open and active involvement of whole organisation and people in company's vision and values.

j) *Process Centred*. Not product or result centred. Each function to re-assess its purpose.

k) *Training:* Education instead of exhortations.

l) *Problem Solving and TQM Too*: Identify most critical quality problems in the organisation Constitute task forces to work out solutions. TQM tools can be very effective in problem solving.

m) *Continuous Improvement*. Not a static but a dynamic concept of improvement. Raise "bench mark" in all areas and achieve organisational excellence.

n) *Measurement and Audit*. Meticulously planned and periodic monitoring systems ensure excellence.

V. OPERATIONAL MODEL FOR TQM

The TQM model provides a distinctly different way of looking at the management style. It looks down from two different considerations towards management as explained below.

1. *Team Work:* It develops a participative culture where every worker is involved in a team relating to his work and decisions concerning his work and fellow employees. Such a team work and Participation is organised through quality circles and quality improvement teams. It develops respect for each other in the organisation.

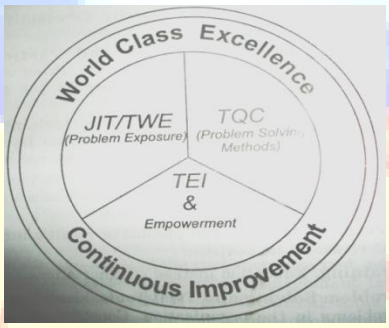

Figure:1 TQM Model

2. *Use of Quality Tools and Techniques for Problem Solving*: It is a system, based on statistical process control techniques and tools aimed at satisfying customer expectations by continuously working across the organization to improve internal and external processes. The rigorous use of tools and techniques by a team ensures the complete analysis and development of solutions.

VI. TQM SYSTEM

Quality system defines as "the organizational structure, responsibilities, produces, process and

resources for implementing quality management."

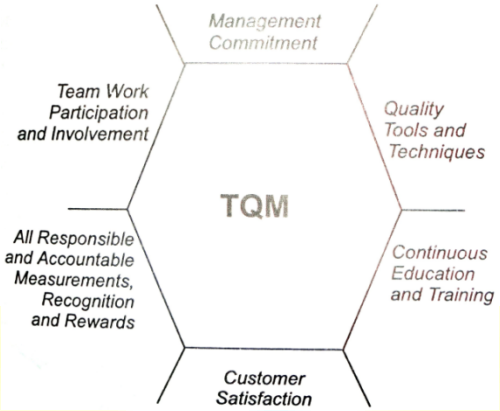

Figure:2 TQM System

VII. METHODOLOGY FOR IMPROVED MEASUREMENT SYSTEMS

It is necessary to examine the measurement to support improvement in the context of a management system. Figure 9.9 explains how improving measurement system is inherently a design process. In Figs, the arrow heads reflect a flow of data, information, decisions and actions as would be the case in actual situations — counter clockwise. In the design and development of performance improvement plans and of performance measurement systems, the flow of measurement is as shown in the design and development loop.

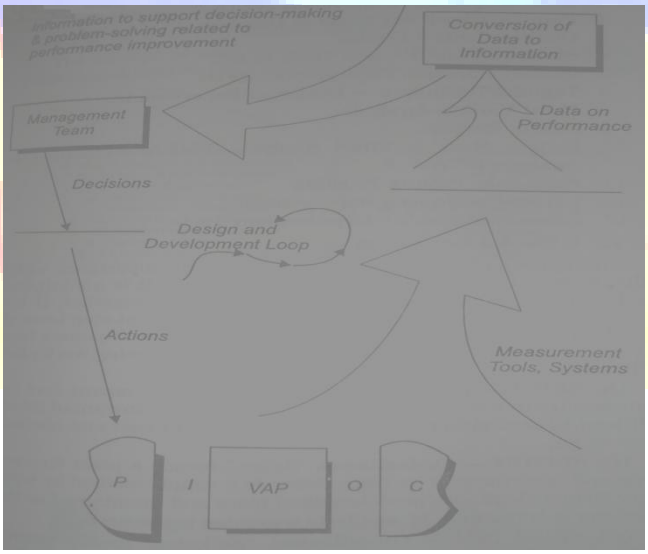

Figure: 3 Improving mesurement systems is inheretently a design process

VIII. TOOLS AND TECHNIQUES FOR TQM

A. The 5 S Campaigns

The upkeep of work place is of paramount importance which helps in quality and productivity improvement. It is a myth that good housekeeping and productivity cannot go together. It has been **proved by Japanese beyond doubt that the first step towards quality improvement is work place utilization**. The Japanese have developed five simple words as a directive for achieving work place utilization.

(A) SEIRI — *Proper Arrangement*. "Seiri" means sort out unnecessary items. In a work place, permitting of unwanted things will lead to occupation of space and create confusion and obstacle to working.

(B) SEITON — *Orderliness*. "Seiton" means a place for everything and everything in its place. Seiton is a simple method by which everything is kept in a predetermined place and maintained so that whenever it is required by anybody searching is not needed.

(C) SELKETSU — *Cleanliness*. "Seiketsu" means prevent problems by keeping things clean". It is very important to e work area very clean with no oil spots, Burrs, dirt or dust' Seiketsu is the method of keeping a clean work place which will a pleasant working environment and result in quality products.

(D)SEISO - *Clean up*. "Seiso" means after work cleaning and maintenance. It is very important to clean the machine and work place and to have routine checks for the machines like fabrication checking air pressure etc. every day to have consistent quality outputs.

(E) SHITSUKE - *Discipline*. "Shitsuke" means maintaining good habits like following work instructions/standards, safety precautions etc. to achieve consistent desired quality of products. Shitsuke provides the guidelines for getting better discipline and work culture.

B. Total Quality Control (TQC).

TQC is an integrated system and methodology throughout the organisation that helps to design, produce and service quality products/services which are most economical for their value, most useful and always satisfactory to the customer.

Elements of TQC.

(a) Quality at source.

(b) Variability reduction through, systematic problem solving methods and systems and procedures. (c) Right the first time.

d) Inching towards Zero variability.

C. Total Employee Involvement (TED)

Employee involvement is a matter of courtesy asking people's opinion before making decisions that affect them. Employee involvement is a very simple process. If a decision is made affecting the employees, it is always better to consult them as they may have some intelligent ideas to offer and this will help in building up the relations and creating a conducive environment for better results.

The employee involvement means that it should involve all employees including managers, supervisors and workers, consulting and communicating with labour organizations, officers associations etc. in matters related not only to operations but also personnel management.

Employee involvement includes different levels of participation by forming groups like quality circles, plant councils, shop councils, work committees, canteen managing committees, hospital apex committee etc.

To sum up, employee participation effectives can be undertaken by following:-

- ❖ A conducive atmosphere to be created and people made to express their opinion.
- ❖ Confidence to be built that the views expressed by one and all will be given adequate weightage.
- ❖ Developing mutual respect, recognizing honesty and cultivating trust are very much essential.
- ❖ All conflict situations to be tackled through direct and tactful approach.
- ❖ Listening actively when team members discuss and asking how they think and feel about the issues.
- ❖ encouraging employees to give creative and innovation solutions.

Robert Conkli, author of How to get people do things says "To the degree that you give either people what they need, they will give you what you need"

D. Plan Do Check Act Cycle of Demings (PDCA Cycle).

The PDCA Cycle is a checklist of the four stages which you must go through to get from `problem-faced' to `problem solved'. The four stages are Plan-Do-Check-Act, and they are carried out in the cycle illustrated below.

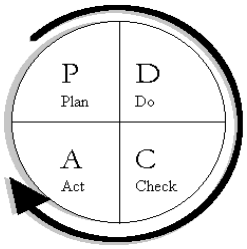

Figure: 4 Plan Do Check Act Cycle of Demings (PDCA Cycle)

The concept of the PDCA Cycle was originally developed by Walter Shewhart, the pioneering statistician who developed statistical process control in the Bell Laboratories in the US during the 1930's. It is often referred to as `the Shewhart Cycle'. It was taken up and promoted very effectively from the 1950s on by the famous Quality Management authority, W. Edwards Deming, and is consequently known by many as `the Deming Wheel'.

E. Quality Control Circles.

Quality control is a process by which organizations analyze the quality of all factors involved in the production process. Quality control is carried out internally by a team or officers, or externally by consultants or a government body to uncover defects in products.
A quality control circle is a small group of workers who come together to discuss ways of identifying, analyzing, solving, and selecting work related issues. More than 95% of work related problems can be resolved using various QC tools. Some of the tools used are the cause and effect diagram, check sheets, scatter diagram, control charts, pareto diagrams, stratification, histograms, and graphs.

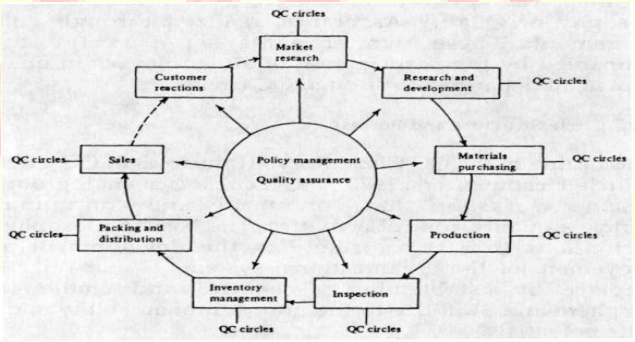

Figure: Quality Control Circles

F. Statistical and Process Tools in QC.

Several techniques can be used to investigate the product for defects or defective pieces after all processing is complete. The purpose of statistical quality control is to ensure, in a cost efficient manner, that the product shipped to customers meets their specifications. Inspecting every product

is costly and inefficient, but the consequences of shipping non-conforming product can be significant in terms of customer dissatisfaction. Statistical Quality Control is the process of inspecting enough product from given lots to probabilistically ensure a specified quality level.

G. Quality Function Deployment (QFD).

QFD (quality function deployment) is defined as a method for developing a design quality aiming at satisfying the consumer and then translating the consumer's demand into design targets and major quality assurance points to be used throughout the production phase. QFD is a way to assure the design quality while the product is still in the design stage (Akao, 1990). From this definition, QFD can be seen as a process where the consumer's voice is valued to carry through the whole process of production and services.

QFD consists of two components which are deployed into the design process: quality and function. The "quality deployment" component brings the costumer's voice into the design process. The "function deployment" component links different organizational functions and units into to the design-to-manufacturing transition via the formation of design teams. (Lockamy & Khurana, 1995)

H. Taguchi Technique — Design of Experiments. Multi Variate Analysis.

Multivariate testing or multi-variable testing is a technique for testing hypotheses on complex multi-variable systems, especially used in testing market perceptions. Multivariate testing is usually employed in order to ascertain which content or creative variation produces the best improvement in the defined goals of a website, whether that be user registrations or successful completion of a checkout process (that is, conversion rate).Dramatic increases can be seen through testing different copy text, form layouts and even landing page images and background colours. However, not all elements produce the same increase in conversions, and by looking at the results from different tests, it is possible to identify those elements that consistently tend to produce the greatest increase in conversions

Statistical testing relies on design of experiments. Several methods in use for multivariate testing include:

a) Full Factorial the most straightforward method whereby all possible combinations of content variants are served with equal probability.

b) Discrete choice and what has mutated to become choice modelling is the complex technique that won Daniel McFadden the Nobel Prize in Economics in 2000. Choice modelling models

how people make trade-offs in the context of a purchase decision. By systematically varying the attributes or content elements, one can quantify their impact on outcome, such as a purchase decision. What is most important are the interaction effects uncovered, which neither the Taguchi methods nor Optimal design solve for.

c) Optimal design involves iterations and waves of testing. Optimal design allows marketers the ability not only to test the maximum number of creative permutations in the shortest period of time but also to take into account relationships, interactions, and constraints across content elements on a website. This allows one to find the optimal solution unencumbered by limitations.

d) Taguchi methods: with multiple variations of content in multiple locations on a website, a large number of combinations need to be statistically tested and medium/low traffic websites can take some time to get a large enough sample of visitors to decide which content gives the best performance. For example, if 3 different images are to be tested in 3 locations, there are 27 combinations to test. Taguchi methods (namely Taguchi orthogonal arrays) can be used in the design of experiments in order to reduce the variations but still give statistically valid results on individual content elements. Taguchi uses fractional factorial designs.

I. Design Review.

In construction projects, new designs are thoroughly reviewed before construction and experimental design is used extensively in structure design. Clarity of specifications and avoidance of frequent redesigns is emphasized. Detail design, schedule and cost estimate, design evaluations, constructability in design, control of design activity are part of design quality management. Thus good design quality management results in an excellent quality of core service that positively influences customer perceptions of quality and an important aspect of TQM.

J. Failure Mode & Effect Analysis (FMEA) & Fault Tree Analysis (ETA).

This method was developed in the 1950s by reliability engineers to determine problems that could arise from malfunctions of military system. Failure mode and effects analysis is a procedure by which each potential failure mode in a system is analyzed to determine its effect on the system and to classify it according to its severity.

When the **FMEA** is extended by a criticality analysis, the technique is then called **failure mode and effects criticality analysis (FMECA)**. Failure mode and effects analysis has gained wide

acceptance by the aerospace and the military industries. In fact, the technique has adapted itself in other form such as misuse mode and effects analysis.

Fault tree analysis (FTA) is a top down, deductive failure analysis in which an undesired state of a system is analyzed using Boolean logic to combine a series of lower-level events. This analysis method is mainly used in the fields of safety engineering and reliability engineering to understand how systems can fail, to identify the best ways to reduce risk or to determine (or get a feeling for) event rates of a safety accident or a particular system level (functional) failure

K. Poka-Yoke-Failure Proofing.

Poka-yoke is a Japanese term that means "mistake-proofing". A poka-yoke is any mechanism in a lean manufacturing process that helps an equipment operator avoid (yokeru) mistakes (poka). Its purpose is to eliminate product defects by preventing, correcting, or drawing attention to human errors as they occur. The concept was formalized, and the term adopted, by Shigeo Shingo as part of the Toyota Production System. It was originally described as baka-yoke, but as this means "fool-proofing" (or "idiot-proofing") the name was changed to the milder poka-yoke.

L. Kaizen-Continuous Improvement.

Kaizen, Japanese for "improvement" or "change for the best", refers to philosophy or practices that focus upon continuous improvement of processes in manufacturing, engineering, and business management.

M. Seven New Quality Improvement Tools.

The Seven Basic Tools of Quality is a designation given to a fixed set of graphical techniques identified as being most helpful in troubleshooting issues related to quality. They are called basic because they are suitable for people with little formal training in statistics and because they can be used to solve the vast majority of quality-related issues. The seven tools are:

1. Cause-and-effect diagram (also known as the "fishbone" or Ishikawa diagram)
2. Check sheet
3. Control chart
4. Histogram
5. Pareto chart
6. Scatter diagram
7. Stratification (alternately, flow chart or run chart)

The designation arose in postwar Japan, inspired by the seven famous weapons of Benkei. It was possibly introduced by Kaoru Ishikawa who in turn was influenced by a series of lectures W. Edwards Deming had given to Japanese engineers and scientists in 1950. At that time, companies that had set about training their workforces in statistical quality control found that the complexity of the subject intimidated the vast majority of their workers and scaled back training to focus primarily on simpler methods which suffice for most quality-related issues.

The Seven Basic Tools stand in contrast to more advanced statistical methods such as survey sampling, acceptance sampling, statistical hypothesis testing, design of experiments, multivariate analysis, and various methods developed in the field of operations research.

IX. CONCLUSION

In this paper, a qualitative analysis has been contacted for the perspectives of total quality management tools. A literature review has been conducted and the TQM tools have been defined. As implementing and developing TQM requires major organizational commitment and effort, there is a need for clear evidence that TQM really has a positive impact on performance. Its main objectives are to provide empirical evidence on the outcomes that may be expected by firms willing to adopt TQM according to this Model and describe a specific measurement instrument to this end.

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