Paradigms of Total Quality Management

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Abstract: - The total quality management is a customer oriented and quality centered type of management that has evolved in Japan after World War II and than, it started to be accepted and applied in America and Europe. During the time, there have been many attempts to construct frameworks that may help organizations in understanding how to implement good quality management. The approaches developed by several authors seem to be similar but they are different at closer look. In this paper we shall find various paradigms of total quality management but also a comparison of them.

Key-Words: - Paradigm, Total Quality Management, Continuous Quality improvement, Total Quality Control.

1 Introduction

So far, Total Quality Management (TQM) has been studied by many authors and each of them has issued a particular view of this emerging science.

According to this, we shall see that many paradigms of TQM can be found, making us to understand the specificity of this type of management.

What does TQM represents?

TQM emerged in the industrial management of the 80s and derives from the concept of Total Quality Control (TQC - Total Quality Control) developed in 1961 by Armand Feigenbaum (see section 5).

The quality standard ISO 9000 issued by The International Organization for Standardization ISO has defined the Total Quality Management as "a management approach of an organization, centered on quality, based on the participation of all its members and aiming at long term success through customer satisfaction and benefits to the members of the organization and to the society" [11].

TQM concept integrates elements and ideas developed by the prominent figures of that period and whose work particularly influenced scientific progress in quality: we speak about total quality control, continuous quality improvement, quality trilogy, "zero defects" objective, etc [3].

Unlike other concepts which are centered on gaining profit, TQM is centered on quality, this type of management being applicable to all the organizations, both government or non-government, engaged in commercial activities or service oriented activities which are non-commercial [19].

During the time, different authors, that later became so-named "gurus" of quality, have brought their own contribution in the development of TQM science: we speak about Edwards W. Deming, Joseph M. Juran, Philip B. Crosby, Armand V. Feigenbaum, Genichi Taguchi et al.

But what is a paradigm?

Thomas S. Kuhn was the one who firstly defined the scientific paradigm concept in 1962 in his book "The Structure of Scientific Revolutions" [10]. He built the concept of paradigm around the idea that in science there were developed different points of view about how everything worked.

The paradigm was defined as a framework of a scientific discipline "which includes law, theory, application, and instrumentation together and who provide models from which spring particular coherent traditions of scientific research". Therefore, a paradigm is a set of practices that defines a scientific discipline at a certain point in time.

In his book, Kuhn also defines the properties of paradigms and their power in structuring scientific research and knowledge. He says that "the paradigm forces scientists to investigate some part of nature in a detail and depth that would otherwise be unimaginable".

In compliance with Longman Dictionary, the paradigm is "a model or example that shows how something works or is produced" [12].

In the following analyze, we shall discover different models of TQM developed during the time by specialists who tried to find a clear way in this labyrinth.

2 Edwards W. Deming

E. W. Deming worked as a statistician in Western Electric Company, USA and he is often called "the father of the Quality Management movement". His teachings were considered to have a leading influence in the revival of the Japanese economy after World War II. In the '80s major corporations in the USA and other countries began to put in practice his management theory.

As Deming said, quality should be checked at each step of a process not by inspecting the product or service once it is completed. In his vision the most quality problems regarding the product or service supplied result from faults in management rather than from the carelessness of workers; he believed that people do their best and it is the system that must change to improve quality [8], [19].

For Deming, quality represents "a predictable degree of uniformity and dependability at low cost and suited to the market" [6]; from his point of view "quality should be aimed at needs of the consumer" [5].

The modern paradigm of quality control can be best summarized in the 14 interrelated points that formed the basis for Deming advice in helping the top management to improve the organization's performances regarding quality [8, 21, 15, 5, 14, 1]:

- 1. Create constancy of purpose toward improvement of product and service with the aim to become competitive, to stay in business and to provide jobs.
- 2. Adopt the new philosophy: we can no longer live with commonly accepted levels of delays, mistakes, defective workmanship.
- 3. Cease dependence on mass inspection to achieve quality; require instead statistical evidence that quality is built in.
- 4. End the practice of awarding business on the basis of price tag; instead minimize total cost.
- 5. Find problems. It is management's job to improve constantly and forever the system of production and service, to improve quality and productivity and thus constantly decrease costs.
- 6. Institute training on the job.
- 7. Institute leadership. The aim of leadership is to help people, machine and gadgets to do a better job.
- 8. Drive out fear so that everyone may work

effectively for the company.

- 9. Break down barriers between departments. People must work as a team.
- 10. Eliminate slogans, exhortations and targets for the work force asking for zero defects and new levels of productivity (they create adversarial relationships).
- 11. Eliminate work standards (quotas) on the factory floor. Eliminate management by numbers, numerical goals. Substitute leadership.
- 12. Remove barriers that rob workers of pride of workmanship.
- 13. Institute a vigorous plan of education and selfimprovement.
- 14. Put everybody in the company to work to accomplish the transformation. Transformation is everybody's job.

The 14 points may be applied in any organization, either small or large, operating in the service industry as well as manufacturing; they apply to a division of a company [5].

3 Joseph M. Juran

J. M. Juran was an American professor by Romanian origin who joined Western Electric Company and developed Western Electric Statistical Quality Control Handbook. Together with Deming, Juran contributed to Japanese organizations success in the 50's and 60's [19, 15]. Juran was the one who promoted the concept known as Managing Business Process Quality which is a technique for executing cross-functional quality improvement [16]. He became well-known for his quality trilogy that implies planning, control and quality improvement.

He defined quality as "fitness for use", characterized by the bellow mentioned features [19]:

- *Quality of design*: through market research, product and concept.
- *Quality of conformance*: through management, manpower and technology.
- *Availability*: through reliability, maintainability and logistic support.
- *Full service*: through promptness, competence and integrity.

Juran established that ten steps have to be followed for continuous quality improvement (see box 1).

Juran used a variety of statistical methods that underpin "the ten steps"; like Deming, he studied under W. Shewhart and thus shares many of the same approaches, for example control charts. One of the best known is Pareto analysis that Juran used in order to separate 'the vital few' problems from 'the useful many' [22]. Box 1 Juran's Ten Steps Roadmap for continuous quality improvement [23, 15, 19]

- 1. Build awareness of the need and opportunity for quality improvement.
- 2. Set goals for continuous improvement.
- 3. Organize to reach the goals (establish a quality council, identify problems, select projects, appoint teams, designate facilitators).
- 4. Provide training.
- 5. Carry out projects to solve problems.
- 6. Report progress.
- 7. Show recognition.
- 8. Communicate results.
- 9. Keep a record of successes.
- 10. Incorporate annual improvements into the company's regular system and processes.

Over the long term, Juran's contribution may be greater than Deming's because Juran has the broader concept while Deming's focus on statistical process control is more technical oriented [16].

4 Philip B. Crosby

Crosby was the Vice President and the Quality Director of International Telephone & Telegraph (ITT) [15, 19]. According to Crosby, quality represents "conformance to requirements" and that for he states that it is necessary to translate requirements into measurable product or service characteristics. This is possible by using numerical specifications that enables one to quantify the characteristics of a product (e.g.: diameter of a hole) or service (e.g.: customer service response time) showing thus the quality level [14].

One of the main Crosby's contributions was a set of four absolutes of quality which are relevant for TQM (see table 1) [19, 15]:

Absolute of	Description		
Quality			
Definition	Quality is conformance to		
	requirements, nothing more		
	or less and certainly not		
	goodness or elegance.		
System	Prevention not appraisal.		
Performance	"Zero defects" not something		
standard	close to it.		
Quality	Price of non-conformance		
measurement	(how much the defects cost		
	the company).		

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On the basis of the four absolutes of quality, Crosby built the 14-steps roadmap for quality improvement in an organization [14, 15]:

- 1. Make it clear that management is committed to quality.
- 2. Set up quality improvement teams with representatives from each department.
- 3. Measure processes to determine where current and potential quality problems lie.
- 4. Evaluate the cost of quality and explain its use as a management tool.
- 5. Raise the quality awareness and personal concern of every employee.
- 6. Take actions to correct problems identified through previous steps.
- 7. Establish a committee for the "zero defects" program.
- 8. Educate and train supervisors on their roles and responsibilities in the quality improvement process.
- 9. Hold a 'zero defects day' to show everyone there has been a change and to reaffirm management commitment.
- 10. Encourage individuals to establish improvement goals for themselves and their groups.
- 11. Encourage employees to communicate to management the obstacles they face in attaining their improvement goals.
- 12. Recognize and appreciate those who participate in quality improvement.
- 13. Establish quality councils to discuss quality matters on a regular basis.
- 14. Do it all over again and emphasize that the quality improvement process never ends.

Crosby is the one who introduced the concept of "zero defects" stating that things should be done right the first time and every time. He stresses motivation and planning and does not dwell on statistical process control and the several problems-solving techniques of Deming and Juran: he states that 'quality is free' because the small costs of prevention shall always be lower than costs of detection, correction and failure [16]. In his vision, senior management is 100% responsible for the problem of quality and its continuance rather than employees [19, 3].

5 Armand V. Feigenbaum

Feigenbaum was a mathematician, the president of American Society of Quality Control (1961-1963) and founding chairman of the International Academy for Quality. He defined quality as [15]:

- "The total composite product and service characteristics of marketing, engineering,

manufacture and maintenance through which the product and service in use will meet the expectations of the customer" and

"Best for the customer use and selling price".

Feigenbaum points of view reflect a systemic attitude of mind: if we have a closer look at the second definition of quality we find two constraints that have not previously been seen: 'customer use' and 'selling price'. The first one may not differ from Deming's "needs of the consumer" or Crosby's "conformance to requirements" but it suggests a constraint rather than an ideal to aim for. It seems to imply that, perhaps, there are limits to useful quality [2].

Feigenbaum was the one who coined the phrase "Total Quality Control" and thus he broadened the quality control into a holistic concept that includes all aspects of a business (the concept is known in Japan as Company Wide Quality Control) [9]. He explains the Total Quality Control as follows: the underlying principle of the total quality view and its basic difference from all other concepts is that in order to provide genuine effectiveness, control must start with identification of customer quality requirements and end only when the product has been placed in the hands of a customer who remained satisfied.

Feigenbaum has developed 'Ten Benchmarks of Total Quality Control for the 1990's' as shown bellow (see box 2):

Box 2 Feigenbaum's 'Ten Benchmarks of Total Quality Control for the 1990's [7]

- 1. Quality is a company wide process.
- 2. Quality is what customer says it is.
- 3. Quality and costs are a sum not a difference.

4. Quality requires both individual and teamwork zealotry.

- 5. Quality is a way of managing.
- 6. Quality and innovation are mutually dependant.
- 7. Quality is an ethic.
- 8. Quality requires continuous improvement.
- 9. Quality is most cost-effective.

10. Quality is implemented with a total system connected with costumers and suppliers.

Feigenbaum's quality approach puts an emphasis of designing of quality and involvement of all departments; statistical methods are used as necessary which contrasts with the statistical emphasis in the work of Deming and Juran [2].

Though, Feigenbaum recommends the use of statistical methods such as histograms, control charts, sampling tables, linear and multiple regression analysis, cumulative curve probability graphs, Taguchi experiments, etc.

6 Genichi Taguchi

Taguchi was a telecom engineer who spent much of his professional life to improve the quality of manufactured products [17]. Among the Japanese approaches to quality, Taguchi methods have been the most widely adopted in America and Europe [1]. In the 80's, he had a great contribution in the quality movement by eliminating the need for mass inspection through the process of building quality into the product at the design stage [2]. His total quality management framework provides two basic ideas [18]:

- the reduction in variation (improved quality) of a product or process represents a lower loss to society;
- the proper development strategy can intentionally reduce variation.

In his vision, quality represents the costs of nonquality which is 'the loss imparted to society from the time the product is shipped'. Taguchi's prime concern is the customer satisfaction and the potential for 'loss of reputation and goodwill' associated with failure to meet customer expectations [2]. For Taguchi, quality can be achieved by minimizing variance. His main concern was how to enable quality to be designed into a product or process, thus quality and reliability being pushed back to the design stage where they belong [4].

That for, he identifies three phases of quality design as shown in table 2:

Table 2 Genichi Taguchi's three phases of quality design [1]

Phase	Description
System design	The development of the basic system presumes experimentation with materials and feasibility testing using prototypes.
Parameter design	Begins with the establishment of optimum levels for control factors so that the product or process is least sensitive to the effect of changes in conditions.
Tolerance design	Basis on setting numerical values (factors) for upper service levels and lower acceptable service levels, reconciling the choice of factors in product design.

Taguchi says there are three stages of quality development in the design of products or systems (see table 3) [1]:

Table 3 Genichi Taguchi's three stages of quality development in the design of products / systems

Stage 1	Determine the quality level as expressed				
	in the off line concept.				
Stage 2	Improve the quality level in a cost				
	effective manner by parameter and				
	tolerance design.				
Stage 3	Monitor the quality of performance by				
	use of feedback and statistical control.				

Taguchi approach of quality management is focused on 'off line' or loss function (derived from telephone system failures) that presumes to [1]:

- Determine the existing quality level measured in the incidence of down time, called 'off line'.
- Improve the quality level by parameter and tolerance design.
- Monitor the quality level by using statistical process control to show the upper and lower level variances.

Taguchi used his experimental techniques to asses the impact of many parameters on a single output; the techniques are centered on kaizen concept which leads us to continuous improvement. His backward step into design process helps to ensure a high basic quality standard [1, 2].

To put it briefly, we can have a closer look at the following table (see table 4, [20, 13, 15]):

	W. Deming	J. M. Juran	P. Crosby	A. Feigenbaum	G. Taguchi
Basic orientation towards quality	technical	process	motivational	total, systemic	technical, proactive
Quality definition	a predictable degree of uniformity and dependability at low cost and suited to the market	fitness for use	conformance to requirements	best for the customer use and selling price	costs of non- quality
Who is responsible for quality?	management	management	management	everyone	engineers
Importance of customer requirements as standard	very important	very important at each step of product life cycle	very important	very important	very important
Goal of quality	meet/exceed customer needs	please customer	zero defects	meet customer needs	meet customer requirements
Methods to achieve quality	statistical; minimize total cost; continuous improvement	statistical; quality trilogy; continuous improvement	translate requirements into measurable characteristics; continuous improvement	statistical and engineering methods; total quality control; continuous improvement	statistical design of experiments; loss function; continuous improvement
Key elements of implementation	14 points program; quality improvement teams	ten steps for continuous quality improvement	14 steps to quality improvement; quality is free	ten benchmarks of total quality control	minimize variance; three phases/stages of quality design & development
Role of training	very important for managers and workers	very important for managers and employees	very important for managers and employees	very important for managers and supervisors	important but not defined

Table 4	Comparisons	of Deming	Juran Crosł	y Feigenhaun	n Taguchi
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As we may notice, the general frame of TQM has common and different features in each author's view. Every author considers that the customer requirements are very important for the company standards and the goal of quality is to meet the customer needs. The definition of quality differs from one author to the other but amongst the methods to achieve quality we may observe that every author considers that continuous improvement is a must.

4 Conclusion

The way TQM is built may differ from a specialist to another but it has certain essential principles that can lead to improving competitiveness, reducing costs and increasing profits. TQM starts with the top management where serious commitment to quality and leadership have to be demonstrated but each employee at each level have to accept the responsibility to achieve the company's quality objectives. The effectiveness of total quality management often requires a mindset change to break down existing barriers.

Adopting TQM ensures that the management organization has a strategic overview of quality and focuses on prevention not detection of problems.

TQM main goal is to meet customer requirements and offer full satisfaction. The basic idea of TQM is that quality is essential in all functions of the business not just manufacturing; it is a system approach that considers every interaction between the various elements of the organization.

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