

TQM, Six sigma and Lean

Mudit M. Saxena,
Assistant Professor

IITE, Indus University, Ahmedabad, Gujarat, India

Dr. KVN Srinivas Rao
Professor

*Dept. of Mechanical Engineering
B V RAJU Institute of Technology, Hyderabad, India*

Abstract

During the past time, completely different quality management ideas, together with total quality management (TQM), 6σ (sigma) and lean, are applied by many organizations. Although abundant necessary work has been documented relating to TQM, six sigma and lean, variety of queries stay regarding the pertinence of those ideas in varied organizations and contexts. Hence, the aim of this paper is to explain the similarities and variations between the ideas, including an evaluation. While TQM, six sigma and lean have a number of similarities, especially concerning origin, methodologies, tools and effects, they differ in some areas, in particular concerning the main theory and approach. The lean conception is slightly completely different from TQM and 6σ (sigma). However, there is a lot to gain if organizations are able to combine these three concepts, as they are complementary. Six sigma and lean are wonderful road-maps, which could be used one by one or combined, together with the values in TQM. The paper provides steerage to organizations relating to the pertinence and properties of quality ideas. Organizations need to work continuously with customer-orientated activities in order to survive; irrespective of how these activities are labeled. The paper will serve as a source for further research in this area, focusing on practical experience of these concepts.

Keywords: Total quality management, Six sigma, Lean production, Quality improvement

INTRODUCTION

While management is taken into account as comparatively immature compared to alternative social sciences, the field has been bombarded with “fads” see, for example, Carson et al. (1999).

In summary, the various management theories bestowed over the years, of that some may be argued to be management fads, are criticized for having four major defects.

The main defects of the management theory are the following:

- (1) it is constitutionally incapable of self-criticism;
- (2) its nomenclature and industry-specific jargon rather confuse than inform;
- (3) it rarely rises above common sense; and
- (4) it is stuffed with fads and weighed down with contradictions that would be intolerable in other scientific disciplines (Carson et al., 1999).

During the last decades, quality management has been proposed by variety of its promoters as a brand new management theory, see, as an example, Foley (2004). However, the outline of what quality management differs. Quality management are often delineated as a management revolution, a revolutionary philosophy of management, a new approach of pondering the management of organisations, a paradigm shift, a comprehensive way to improve total organizational performance, an option to management by control or as a framework for aggressive management (Foley, 2004). Regardless of the high endeavor of supporters of quality management, the failures of organizations trying to realize a successful quality management programme have been well documented, see Brown et al. (1994), Eskildson (1994), Harari (1997), Cao et al. (2000) or Nwabueze (2001). These failures have led some authors to question whether or not some ideas within the space of quality management are fads, see, as an example, vander Wiele et al. (2000). John Godfrey Saxe’s famous fable “The Blind Men and the Elephant” in which six blind men attempt, and ultimately fail, to describe an elephant could actually be a good description of quality management. In this story, each blind man touches only a part of the elephant. They go on to explain what the elephant appears like. For example: one blind person says “the elephant appears like a wall” another blind person describes it as “the elephant looks like a snake”.

In much the same way as each blind man forms a vision of the entire by examining a region, promoters of quality management have written books and articles and bestowed seminars concerning completely different concepts, that are either concerning the components or are visions of the entire drawn from the knowledge of one or a few parts, see Foley (2004). Concepts that have been revealed are, as an example, total quality management (TQM), six sigma, lean manufacturing, business process re-engineering, just-in-time (JIT), Kaizen and business Excellence.

However, the outline and definition of those completely different quality management concepts differ. For example, TQM is typically outlined as an unceasingly evolving management system consisting of values, methodologies and tools, the aim of that is to extend external and internal client satisfaction with a reduced quantity of resources, see Hellsten and Klefsjo (2000).

Six sigma, on the other hand, is outlined as a business method that enables corporations to drastically improve their bottom line by planning and watching everyday business

activities in ways that minimize waste and resources whereas increasing client satisfaction by a number of its proponents, see Magnusson et al. (2003).

NIST (2000) defines lean as a scientific approach to characteristic and eliminating waste through continuous improvement, flowing the product at the pull of the customer in pursuit of perfection. While the definitions of TQM, six sigma and lean dissent, the aim of the various ideas looks to be similar; through enhancements minimizing waste and resources whereas rising client satisfaction and financial results. These ideas even have a similar origin, the quality evolution in Japan after the second World War, see Dahlgaard and Dahlgaard (2001).

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With parallels to the fable described above, one could argue that different promoters in the field of quality management (the six blind men), who each describes different quality management concepts (the wall, snake, etc.), are trying to explain a part or a vision in relation to the whole; the area of quality management (the elephant). However, the components or the visions concerning the entire disagree, according to the definitions contributed of TQM, Six Sigma and lean (which also was the case for the six blind men). On the opposite hand, and as shown on top there also are several similarities for instance, with relevance the general aim and origin. Therefore, one may additionally argue that the various promoters (the six blind men) in some areas are ready to describe the same vision of the complete (a similar image of the elephant). Hence, and in outline, this paper sets out to describe if the vision of the different promoters of quality management concepts (TQM, six sigma and lean) is the same or if it differs. Although considerable progress has been made in the field of quality management in general and in TQM, six sigma and lean in particular, many important issues remain unexplored concerning the similarities and differences between these concepts. Hence, the aim of this paper is to explain similarities and variations between TQM, six sigma and lean.

In specific, similarities and differences concerning areas such as the methodologies, tools, effects are illuminated in this paper. Furthermore, an overall explanation of each notion is contributed in this paper.

Quality management concepts

Total quality management (TQM)

Quality has been an important issue for organizations for many years. The early knowledge in quality evolved from review to internal control and later to quality assurance, according to Dale (1999). During the Nineties, TQM evolved as a typical term among organizations. Different definitions of TQM are given over the years. Dahlgaard et al. (1998) read TQM as a company culture characterized by accumulated client satisfaction through continuous improvement, in which

all employees in the firm actively participate. Shiba et al. (1993), on the other hand, argue that: TQM is an evolving system of practices, tools, and training methods for managing companies to provide client satisfaction in an exceedingly apace dynamic world. Hellsten and Klefsjo (2000) support the thought that TQM is an evolving system. Hellsten and Klefsjo (2000) summarize Total Quality Management as a endlessly evolving management system consisting of values, methodologies and tools, the aim of which is to raise external and internal customer agreement with a reduced amount of resources.

Methodologies and Tools

Hellsten and Klefsjo (2000) disagreed that methodologies are “ways to figure at intervals the organisation to attain the values”. Tools that are oftentimes mentioned within the TQM literature embrace the seven internal control tools, see Shewhart (1980) and Ishikawa (1985), and the seven management tools, see Mizuno (1988). The improvement cycle is additionally a typical methodology so as to enhance the business, according to Evans and Lindsay (1996). The improvement cycle consists of 4 stages: set up, do, study and act (PDSA).

Effects

Vokurka et al. (2000) argue that, with customers rigorous quality and competitors responding to such demands, business turned to TQM because the key to reinforce overall performance. There are many different approaches to evaluating the possible benefits of TQM. Historically, one of the most common ways to quantify the benefits of quality has been to estimate the costs of poor quality, see, for example, Juran (1989) and So rqvist (1998). In recent years, research has also shown that one of the goals of TQM, customer satisfaction, has a significant positive impact on market value as well as accounting returns, see, for example, Andersson and Fornell (1994) and Eklo et al. (1999). The General Accounting Office (GAO) study was one of the first studies trying to establish a link between TQM practices and the performance of companies, see GAO (1991).

In the study, Malcolm Baldrige recipients and organizations that had received a site-visit (i.e. companies were near to receiving an award) were evaluated. The main conclusion from the Government Accounting Office study was that the businesses investigated had improved their in operation results. Moreover, better employee relations and improved operating procedures had been achieved, greater customer satisfaction had been accomplished, and an increased market share and profitability had been gained.

Hendricks and Singhal (1997) and Eriksson and Hansson (2003) compare recipients of quality awards with totally different control corporations. The main conclusions from their research are that companies that have received a quality

award outperform the control companies concerning operating income-based measures and other indicators during a period that follows the announcement. For instance, the growth in operating income for recipients averaged 91 per cent during a period that followed the award announcement, in contrast to a 43 per cent average growth for the control groups, see Hendricks and Singhal (1997). Lemak AND Reed (1997) conjointly claim that TQM ends up in an improved margin of profit, after studying 60 companies that had demonstrated a commitment to TQM for a period of at least five years.

Six sigma

In 1988, Motorola received the Malcolm Baldrige National Quality Award, that led to an augmented interest of six sigma in alternative organisations, see Pyzdek (2001). Today, variety of worldwide organisations have developed six sigma programmes of their own and 6 sigma is currently established in nearly each business. Six sigma is outlined as a business method that enables firms to drastically improve their bottom line by coming up with and observance everyday business activities in ways in which minimise waste and resources whereas increasing client satisfaction by a number of its proponents, see Magnusson et al. (2003). Six sigma may even be delineated as an improvement programme for reducing variation, that focuses on continuous and breakthrough enhancements. Improvement comes are driven in a very big selection of areas and at totally different levels of complexness, so as to scale back variation. The main idea of reducing disparity on a product or a service is to satisfy customers. The goal of Six Sigma is that solely 3.4 of a million customers should be unsatisfied, see Magnusson et al. (2003).

Methodologies and tools

Henderson and Evans (2000) claim that the main parts for a successful 6σ implementation are management involvement, organisation, infrastructure, training and statistical tools. Eckes (2001) also points out the importance of having an infrastructure before starting an improvement programme, like six sigma, and further claims that "successful organisations use a model for improvement" relatively in operation impromptu whereas not a model. One of the most important issues of the infrastructure is the involvement of the management, see Eckes (2001). Panda et al. (2000) mean that the organization additionally should clarify the various roles needed and their different areas of responsibility so as to achieve success with a 6σ programme. According to Magnusson et al. (2003), the hierarchy of responsibilities and the roles are: Champions and Sponsors, Master Black Belts, Black Belt, Green Belt, White Belt. Sanders and Hild (2000) claim that 6σ organisations often have standardised training courses, ranging from comprehensive courses for Black Belts to basic courses for White Belts. There are 2 major improvement methodologies in six sigma, one for

already existing processes and one for new processes. The first methodology went to improve it in nursing existing method are often divided into 5 phases, see Pyzdek (2003) and Magnusson et al.(2003).

These are:

(1) Define

Define that method or product that desires improvement. Define the most appropriate team members to figure with the development. Describe the customers of the course, their needs and requirements, and create a map of the process that should be improved.

(2) Measure

Identify the key factors that have the foremost influence on the method, and decide upon how to measure them.

(3) Analyse

Analyse the factors that need improvements.

(4) Improve

Design and implement the most effective solution. Cost-benefit analyses should be used to identify the best solution.

(5) Control

Verify if the implementation was sure-fire and make sure that the development sustains over time.

The second methodology is usually used once the present processes don't satisfy the shoppers or aren't ready to accomplish strategic business objectives, see Eckes (2001). This methodology may also be divided into 5 phases; outline, measure, analyze, design, verify, according to Magnusson et al. (2003). In summary, the 2 totally different methodologies have obvious similarities. There are sometimes many various improvement tools utilized in a 6σ programme. Magnusson et al. (2003) document that the 6σ tool chest contains the seven style tools, the seven statistical tools, the seven project tools, the seven lean tools, the seven customer tools, the seven internal control tools and also the seven management tools. The tools are typically straightforward to use in each in progress and breakthrough improvement comes, however there also are some additional advanced applied math tools within the tool chest.

Effects

Much of the increased interest in six sigma programmes is due to the positive financial impact some companies claim that the programmes have. For example, Volvo Cars in Sweden claims that the six sigma programme has contributed with over 55 million euro to the bottom line during 2000 and 2002, see Magnusson et al. (2003). Another company that has been sure-fire with their 6σ is that the Business Unit of Transmission & Transportation Networks at Ericsson set in

Boras, Sweden. Ericsson in Boras has about 1,100 employees. According to Peter Hayhanen, a promoter and educator at Ericsson, they started their six sigma programme in 1997. At Ericsson, 6σ (sigma) was initially outlined as a technique for finding issues.

Today, they rather see 6σ (sigma) as a business excellence model for concrete areas and as a technique so as to succeed in business goals. At Ericsson in Boras, about fifty Black Belt projects and two hundred Yellow Belt projects are executed between 1997 and 2004, with total savings of roughly 200-300 million monetary unit between 1997 and 2003. (The company admits it is very difficult to estimate the savings due to the fact that they do not measure the total savings anymore.)

Lean

Methodologies and tools

Lean principles are basically client worth driven, which makes them appropriate for many manufacturing and distribution situations.

Five basic principles of lean producing are usually acknowledged:

(1) Understanding customer value

Only what the shoppers understand as worth is vital.

(2) Value stream analysis

Having understood the value for the customers, the next step is to analyze the business processes to determine which ones actually add value. If this action doesn't add worth, it should be modified or eliminated from the process.

(3) Flow

Focus on organizing a constant flow through the production or supply chain relatively than moving commodities in large batches.

(4) Pull

Demand chain management restricts from producing wares to stock, i.e. customer demand pulls finished products through the system. No work is conceded out except the result of it is required downstream.

(5) Perfection

The elimination of non-value-adding components (waste) may be a method of continuous improvement. "There isn't any finish to reducing time, cost, space, mistakes, and effort" (McCurry and McIvor, 2001).

Lean principles don't perpetually apply, however, once client demand is unstable and unpredictable. The most components conducive to the elimination of non-value-added activities are the following: excess production, excess process, delays, transport, inventory, defects and movement. A variety of approaches are available for reducing or eliminating waste. These approaches include value stream analysis, total productive maintenance, Kaizen cost accounting and value analysis, engineering and change management, and document

management. Tools used include Kanban cards for pull through the supply chain and therefore the closely connected JIT system for inventory reduction.

Effects

There are quite a few reasons to introduce lean techniques in related organisation, as it may contribute substantially to cutting costs and providing competitive advantages. Lean edges embrace reduced work-in-process, magnified inventory turns, magnified capability, cycle-time reduction and improved customer satisfaction. According to a recent survey, see agency (2003), of forty corporations that had adopted lean producing, typical improvements are visible in three areas.

These improvement areas embrace operational enhancements (reduction of some time interval, increase in productivity, reduction in work-in-process inventory, etc.), administrative improvements (reduction in order processing errors, streamlining of customer service functions so customers aren't any longer placed on hold, etc.) and strategic enhancements (reduced prices, etc.).

Origin and theory

Even though TQM, 6σ (sigma) and lean have identical origin (the quality evolution in Japan), the concepts have developed differently. Total Quality Management become a very popular concept in the beginning of the 1990s among researchers and practitioners in order to describe how organizations should work to gain better performance and customer satisfaction. TQM is usually related to the outstanding figures at intervals the sphere of quality management, as an example, Deming and Juran, but they have in general not used the term TQM.

The success with 6σ (sigma) at Motorola and with lean at Toyota may be a main reason for these concepts to spread to other organizations. In contrast to six sigma and lean, no organization was the origin to the term TQM (there is in progress discussion on United Nations agency really labeled TQM). A notable distinction between 6σ (sigma) and lean is that Motorola labeled Six Sigma, see Rancour and McCracken (2000), while authors in the field, Womack et al. (1990), labeled the lean concept. George et al. (2004) claim that the main difference between 6σ (sigma) and lean is that the previous focuses additional on accomplishing no defects, while the latter is a better choice when one wants to improve process flow and eliminate waste. TQM also has elements of accomplishing no defects and eliminate waste, but with the main objectives to increase external and internal customer satisfaction with a reduced quantity of resources, see Hellsten and Klefsjo (2000).

Process view and approach

The improvement comes during a 6σ (sigma) programme are conducted during a wide selection of areas and at totally different levels of quality so as to cut back variation, see Magnusson et al. (2003). When the project members have

reduced the variation in a process, and hence achieved the business goals, increased the profit or lowered the cost, this improvement is visualized to the top managers at the company. Frequently some of the top managers are also involved in the performed development projects. As a result, the six sigma programme receives necessary support from the highest managers at the corporate, as the managers recognise the economical impact of it. This could be one explanation for the documented successes of six sigma compared with TQM, i.e. six sigma programmes speak the highest managers' language (the economical gains of the improvement). Lean, on the opposite hand, could be a discipline that focuses on method speed and potency, or the flow, in order to increase the customer value; see George et al. (2004). In lean producing, project groups are usually the approach to perform the necessary improvements. While six sigma and lean specialize in playacting enhancements mainly through comes, TQM has sometimes a different approach. TQM emphasizes the commitment and involvement of all employees, see, for example, Bergman and Klefsjo (2003). In TQM, there's conjointly, like 6σ (sigma) and lean, a powerful specialise in processes. It is the authors' view that the main aims of the process work within Total QualityManagement are to alternatively improve and uniform the processes.

DISCUSSIONS

The conferred ideas show several similarities, particularly 6σ (sigma) and TQM. However, the package of quality tools, the attention to financial result, the sustaining of the gains, and the focus of the problem solving methods of projects are new approaches in six sigma compared to different ideas in quality management. Klefsjo et al. (2001) argue that 6σ (sigma) ought to be thought to be a technique among the larger framework of TQM. One reason for this can be because of the actual fact that six sigma supports all the six values in TQM, see Klefsjo et al. (2001). Dahlgard and Dahlgard (2001) additionally state that there's not any contradiction between the objectives in lean and TQM. They support the study conferred by Klefsjo et al. (2001) above, and argue that six sigma and lean should rather been seen as a collection of concepts and tools, which support the overall principles and aims of TQM. Dahlgard and Dahlgard (2001) mean that 6σ (sigma) and lean have clear road-maps so as to attain business excellence, but it is important in order to be successful to stress the company culture and human think about these ideas. TQM is often accused for being blur and unclear, and it is, therefore, the authors' opinion that 6σ (sigma) and lean can be appropriate approaches for organizations in order to make vital progress within the field of quality management. Recently, the term lean 6σ (sigma) has been recommend by, for example, George et al. (2004) and Martichenko (2004). In specific, George et al. (2004) claim that: Lean 6σ (sigma) helps corporations flourish in a very new world wherever customers expect no defects and quick delivery at the lowest price. Magnusson et al. (2003) additionally state that several corporations have incorporated 6σ (sigma) and lean producing practices. The merger can be traced back to early developments at General Electrics where

they realized that the two concepts complemented each other very well, i.e. lean producing addresses method flow and waste whereas 6σ (sigma) addresses variation and style.

This paper has targeted on a theoretical description and comparison of 3 quality management ideas. Further research in this area will need to focus on the practical experience of these concepts, and contribute to a better understanding concerning which concept is most appropriate in different situations. Furthermore, a more detailed description of how these concepts can be combined needs to be presented in order to facilitate for organizations to meet and exceed the demands of future customers and survive in an excellent additional competitive setting.

CONCLUSIONS

The purpose of this paper is to explain similarities and variations between TQM, six sigma and lean. With parallels to the fable represented higher than, one could argue that the blind men's visions about the whole are very similar; the three presented concepts have many similarities, especially concerning origin, methodologies, tools and effects. However, the blind men's vision concerning the full additionally differs slightly in some areas; particularly regarding the most theory, approach and the main criticism. Comparing the different quality management concepts, TQM and 6σ (sigma) show many similarities, while the lean concept is slightly different compared to the previous two. However, it's the authors' recommendation that there's plenty to realize if organizations are able to mix these 3 ideas. Indeed, the concepts are complementary; especially 6σ (sigma) and lean are excellent road-maps, which could be used one by one or combined, in order to strengthen the values of TQM within an organization. Even if a number of the conferred ideas are suspect for being management fads, it's the authors' opinion that organizations incessantly have to be compelled to work with customer-orientated activities in order to survive; irrespective of how these activities are labeled today and in the future.

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