

# Cost of Poor quality: Quality management in Lean manufacturing and the effectiveness of the “Zero defects” goal”<sup>1</sup>

**Rajaa Taidi**

Abdelmalek Essaadi University-National School of management  
Research group in management and information system  
Avenue Sijilmassa, Res Al hamd N3  
90000  
Tangier Morocco  
E-mail: rajaa.taidi@gmail.com  
Telephone: +212 675 700 732

## **Abstract**

*“This paper is aiming to study a debatable issue in quality management which is “zero defects”. The main intention is to know how it was exactly approached by quality gurus and different researchers, and how other methodologies like Six Sigma have the same defect oriented views. The findings of this paper will provide arguments that will prove that “zero defects” should never be a motivational tool and that all the defect oriented methodologies lack some points to reach a better “quality”.*

**Keywords:** Zero defect, lean manufacturing, lean six sigma, motivational tool, Quality management

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## **1. Introduction**

Quality model is a strategy that tackles the quality issue that the companies have. It rests on the idea that businesses can success only if it manages to satisfy their customers” real needs and to improve continuously in order to reach that. Quality model and its principles will be tackled with more details in the literature review of this paper, but what important to know is that pretty much all the methods known today as total quality management, lean, and six sigma are rooted from the quality model. And they all share the idea of reaching a better “quality” whereas a higher performance is to be reached at the end of the day. The title of the paper refers to the practices used in lean manufacturing companies and how do they deal with quality management issues. According to the “quality resources for achieving six sigma results” website, a survey showed that almost 70% of manufacturing companies nowadays use lean manufacturing practices.

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## **2. Literature review**

Quality management has always been a proportional field of distinguished opinions and views especially from the gurus of the middle of the 20th century. To some extent, quality management is perceived as a recent science compared with other branches of business. However, most researchers consider it one of the oldest practices in businesses whereas it started with the simple trader in ancient times who tried to make good quality products in order to make his living. One of the most controversial issues in quality management is the improvement processes and the defects eliminations. On view of that, the quality gurus such as Philip Crosby, Joseph M.Juran, William Edwards Deming, and others introduced several theories that addressed these issues such as “Zero-defects goal” and “Six sigma” This literature review will be a window for me to present a brief history of how quality management developed over the years and how the idea of “zero defects” came to existence. Also, the goal is to familiarize the reader with the movement of quality management in the last century to put him or her in the picture before starting to discuss the research questions. In the beginning, by defining the quality model that is believed according to “Raphael L. Vitalo” to be the root from where the majority of current trends like Six Sigma and Total Quality management came from. Then, introducing the work of Crosby who introduced to the world the philosophy of the “zero effects” (actually there is a debate on this matter since some people claim that Motorola came with the idea first). After explaining thoughtfully the concept, the author will present Six Sigma as a tool for quality improvement, and show at the same time the similarities it has with “zero defects” orientation. Later there will be a presentation of Juran’s work and how he perceived Six Sigma. Last but not least, A description of Demings’ philosophy, how he perceived “zero defects”, and also brief overview of the work of Taguchi.

### ***2.1 Crosby’s zero defects goal philosophy***

Crosby is one of the most famous gurus of quality management. He started developing the idea of “Zero-defects” in the “Martin Company Orlando, Florida plant”. He was back then the quality manager of the Pershing missile program. His ideas and practices are still considerably influencing and important to this very day. He died of respiratory failure in the 18th of august, 2001. According to Crosby in his book “quality is free”, quality defects have significant costs whereas the most obvious ones are money, recourses, and time. Moreover, developing programs that eliminate these defects can be very expensive and time consuming.

Accordingly, Crosby raised some questions such as “are you willing to remove the defects no matter what the cost might be?”, and also “are you willing to live with these costs in order to achieve quality?” Those questions address the meaning of the title of the book “quality is free”. Accordingly, the only solution is to not have any defects to begin with. In other words, having zero defects will save the management the money associated with quality measurement and hence gives an achievable quality for free. One interesting point to mention is that Crosby insisted that this philosophy is not a procedure but a way of thinking which makes it a very effective idea since it could be adapted to every situation, industry, or business. Zero-defects goal is not simply about perfection, it is about adopting a new perspective and a new style of thinking of eliminating errors by respecting the following three guidelines, Recognize the high cost of quality issues, Continuously think of the places where flaws may be introduced and Work proactively to address the flaws in your systems and processes, which allow defects to occur.

## ***2.2 Introduction to Lean Six sigma***

The concept of “zero defects” introduced by Philip Crosby was, in essence, that all errors can be avoided and that there is no excuse for any defects. The concept has been known for more than 40 years and several Japanese companies implemented this philosophy during this period. However, the concept was not popular in the United States for some time and it was until the mid-1980s that the concept started to take place. Motorola Inc. was the main company relying on the concept and made it popular in the USA. Furthermore, they were measuring quality by the number of the defects per million opportunities creating as such six levels of achievement, with “Six Sigma” being the top level. Six Sigma was initially introduced as a quality performance measurement. It has evolved later into a statistically oriented approach to enable process improvement. It is a popular approach particularly among the innovation and technology driven companies like General Electric, Kodak, and Allied Signal. The prime objective is to reduce the output variability to a minimum through process improvement. By doing so, it is possible to limit the defect levels to below 3.4 defects per million. Joseph Juran, one of the legends of quality management in the 20th century was asked in 2000 by quality digest magazine about his opinion concerning Six Sigma and he said “From what I've seen of it, it's a basic version of quality improvement. It originally started with Bob Galvin, the former CEO of Motorola and a very ardent pursuer of excellence in quality. Now, to reduce it from a few percent defective to three per million, that's four orders of magnitude” (Quality Digest magazine, Juran a lifetime of quality, 2002). In other words,

Juran is pointing out the big similarity between Six Sigma and the Zero-Defect goal whereas both of the methodologies perceive high quality as the absence of defects, and both are defect oriented.

### **3. Gurus of Quality's Perception**

#### ***3.1 Juran's Perception of quality***

Juran is one of the famous gurus of quality. Juran became well known for the first time in the U.S quality field by being the editor of the "Quality Control Handbook", and more after publishing his research where he introduced the quality trilogy. Juran's approach is evolutionary and he insisted on several occasions that the language of the business world is money and that quality efforts have to be communicated to management in their language. Juran has different views if they are to be compared with other gurus, especially Crosby. They had difference perspectives towards several issues whereas cost of quality, and defect control and the degree of senior managers' involvement were the main ones. For the other point of difference, Crosby sees that all defects come from two factors which are the lack of the knowledge required, or a lack of attention. For Juran, it is not quite the same since he believes that the majority of quality problems can be traced directly to the poor management of senior managers and that is, often times, the real reason, whereas the poor performance of workmanship is less dangerous and affecting. Also, he believes that the operating errors can be reduced by keeping people attentive, mistake proofing establishing accountability, and other tools that can ensure better quality performance. (Quality times by Free quality resources).

#### ***3.2 Deming Perception on quality and zero defect methodology***

W. Edwards Deming is best known for helping the Japanese manufacturing sector after the ruins of the Second World War. The highest award in Japan is called "The deming prize" in his honor vu the accomplishments that he made there. Deming is also known as one the classical gurus of quality management, especially his fourteen points and the theory of Profound Knowledge. As far as the concept of the "Zero-defects" is concerned, Deming had some remarks that fall in the disadvantage of this methodology. According to the later, the idea of limiting the defects for the customer is a good idea. He was also adamant about the necessity of applying mistake proofing (whereas the main idea is to create systems and procedures that make making mistakes in production really rare and difficult to happen) to eliminate all internal mistakes at the level of the design of the products under production.

However, he claimed that the “zero-defect” is not a good strategy even if it engulfs good ideas. According to him he said “No defects, no jobs. Absence of defects does not necessarily build business.... Something more is required” (W. Edwards Deming, *New Economics*, page 10). Also, he said “Eliminate slogans, exhortations, and targets for the work force asking for zero defects and new levels of productivity” (Deming, 14 points of management). And, last but not least, Scott M. Paton (from the W. Edwards Deming Institute website) said on his behalf “Through the day Deming took swipes at a lot of today’s popular buzzwords.

### ***3.3 Brief overview of the Taguchi Model***

Genichi Taguchi is a double winner of the Deming price. He is a Japanese engineer who made important contributions to the field of quality management. He defined quality as “Any engineered system reaches its „ideal function“ when all of its applied energy (input) is transformed efficiently into creating desired output energy” (Taguchi on Robust Technology Development: Bringing Quality Engineering Upstream; Asme Press, New York, 1993). Last but not least, Taguchi presented the notion of “Quality loss” in which he illustrates the amount of waste that companies lose whenever they drive away from target results. According to the latter there should not be only “low specification” and “high specification” extremes in which the products that lie between are “acceptable”. Because in this case some of them are either giving too much service or too little service, and in both case there is a creation of loss to society and there is a waste in the system. To quantify the loss the formula is:  $L(y) = k(y-m)^2$  given that  $L(y) = \text{Loss}$   $k = \text{constant} = \text{cost to correct tolerance}^2$   $y = \text{reported value}$   $m = \text{mean value (average)}$  (Taguchi On Robust Technology p. 22). But more is to be discussed about the Taguchi’s model in the discussion section.

## **4. Methodology of the research , Discussions and results**

To answer the three research questions mentioned at the end of the introduction Different type of analysis and tools have been used, since the questions differ in nature. A first part called “Findings” and it going to give direct results to the findings found in papers, theories analysis, and the survey collected. The findings in this section will be in terms of points to facilitate the task for the reader. After presenting the findings using all the tools that will be presented shortly in this section, to introduce a “discussion” part that will discuss in concrete details all the aspects covered.

**The first research question** aims at analyzing the effectiveness of using “zero defects” as a motivational tool. Some companies use slogans and banners that call for that goal. The nature of this question calls for some empirical evidence so that there could be conclusions drawn from it to show whether actually the goal is of a motivational nature or not. But before collecting data from any given company, a throughout understanding of “zero defects” is a must. To analyze the fourteen points that Crosby implemented and understand what he meant exactly by “zero defects” in his “quality for free book”. We tried to make a simple survey in a company back in my hometown Tangier, Morocco in order to tackle some of the questions that were important. Unfortunately the plan was to have a Skype interview with the quality manager in order to cover more issues of how the company “**Yazaki Tangier**” deals with quality management but it could not be done due to shortage of time and his busy schedule. On the other hand 23 surveys that were collected out of 30 and on the lights of the information given by employees there was some answers that will be discussed further in the “analysis” part of this thesis. Of course 23 surveys cannot give evidence that could be generalized on other companies or even for the cabling sector for that matter, but for the scope of this thesis it could be an added value that can check more or less what have been reading on different papers about the issue.

**The second research question** is of a philosophical nature. Humbly, to understand whether the goal of “zero defects” is a proper goal for companies to pursue or not. Again, the issue will be tackled from a theory based perspective, so no empirical data is to be collected or needed, Some critics that the quality guru Juran presented and that show to a big extent the similarities between Six Sigma and Crosby’s “Zero defects” methodology.

**The third and last research question** deals with the differences between Six Sigma being a methodology that concentrates on the “zero defects” mindset, and the teachings of Deming in his profound knowledge. To rely mainly on three main recourses. The first paper that will refer to is “why I dislike the name Six Sigma” by Rafael Aquayo. In this paper he criticizes some issues that Six Sigma as been presenting and he mentions some of the points that existed in Deming philosophy but lacks in “Six Sigma”. The second paper is “Deming management Philosophy and the So-called Six Sigma quality” by David Wayne in which he compares and contrasts Dr. Deming’s philosophy with that of the Six Sigma methodology by describing the differences, commonalities, and the effectiveness of each methodology. Last but not least, the third reference will be an article from “Quality digest” and the name of the article is “Six Sigma lessons from Deming”. Those three references because of their relevancy to what the research question is aiming for and because of the nature of criticizing that they engulf.

#### ***4.1 Findings Vs Discussion***

Is “zero defects” a good motivational tool? The findings of the different tools used to analyze this research question will be presented in terms of bullet points and the results of the survey are presented in terms of graphs in appendix the findings are:

- “Zero defects” is a bad motivational tool according to Deming. “Zero defects”, as a motivational tool, creates unproductiveness and de-motivates employees. “Zero defects” terminology infers perfection which increase tension among employees as failure to reach such goal is of a high probability. “Zero defects” as a motivational tool dives away from the ideology presented by Crosby and illustrates a bad understanding from the management.

Is the objective of “zero defects” and the defect oriented methodologies the answer to reach quality? This research question is of a philosophical nature, so no empirical data was to be collected. The findings of the papers and resources used are as the following:

- “Zero defects” is a defect oriented methodology and Six Sigma is nothing but a developed version, “Zero defects” and “Six Sigma” call for continuous improvement, yet in practice the horizons of those defect oriented goals are limited. Defect oriented methodologies lack some points presented in Deming’s philosophy. Using the “part” philosophy, and the paradigms of acceptability and desirability, “zero defects” goal is limited and cannot reach customers’ delight on a continuous basis. Taguchi’s model shows that defect oriented methodologies do not consider quality loss.

Is “Six Sigma” a technical application of Deming’s philosophy or does it lack some profound knowledge points? This research question is comparing Deming’s perceptions and the technical aspects of Six Sigma. The findings are as follows:

- There are several similarities between the two methods even if Deming is more into theory and that Six Sigma is more technical. The similarities are in issues like constancy of purpose and the importance of defects in cost savings. There are several differences in core values like managing employees and the perception of quality. Even if both agree that defects should be minimized, the perception is completely different. “Six Sigma” methodology focuses on decreasing the level of defects to reach quality whereas Deming calls for implementing quality in the first place into products, which in return, will decrease the level of defects.

The findings mentioned above will be discussed thoroughly in the “discussion” part with more details and more explanations.

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## ***4.2 Similarities and Differences***

First of all, the process that Six Sigma follows seems similar to Deming’s cycle (Plan-Do-Study-Act) even if Six Sigma, forefront the “plan” phase, brings experimental design as a first step. In Six Sigma, the design phase is a key function to achieve six sigma performance levels, and it employs special attention to planning the design phase of its production; which resembles the “Plan” phase in its promotion of the importance of establishing a systematic relationship between inputs and the desired output, as well as the needed production



processes. Another similarity is the constancy of purpose. Deming criticized titles like “Program of the month” to drive improvement and he always answered ironically that “there is no instant pudding.” He added that change sometimes is a necessity and that dynamics of the market can oblige the businesses to adjust its planning; however, it should never wave from the principles of Profound Knowledge that he presented. Similarly, the companies that managed to implement Six Sigma successfully follow the same ideology and it is applied in Six Sigma’s tactical level. Last but not least, even if the methodology of Six Sigma regarding defects differs from the one of Deming (in terms that Six Sigma view reducing defects as increasing quality), one of the most recognized differences between Deming’s teachings and Six Sigma is the belt system that Six Sigma has. Black belts (as described in the literature review) are given responsibilities to assign improvements in given projects. That contradicts what Deming suggested as the quality is everyone’s responsibility. In Deming’s teachings, the management has to appreciate the participation of every employee in the company, create a sense of teamwork, and listen to employees which will generate joy in work that can drive the motivation as well as the performance to higher levels. He criticized the fact that workers had become some kind of commodity that can be bought or disposed of. In other words, businesses should not treat workers as numbers, and try instead to understand their psychology and make them proud of what they produce so they can reach out the best quality. Unlikely with Six Sigma, the methodology is number-oriented and it treats employees as mere inputs, which according to Deming, is short sighted and even if it brings profits on the short term, it will result in the downfall of the business.

## **5. Conclusion**

Quality concerns have always been in the mindset of any producer since the start of business in old times. Today, with the increasing diversity in goods and services and the tremendous increasing pace of competition due to globalization and free movements of products and services across the borders, called for what academics call the quality movement. Walter A Shewhart and Edwards Deming were one of the earliest founders of what is called today quality management. One of the most distinguishing theories that were presented in this movement was the concept of “zero defects.” At first, the goal sounds appealing since defects are obviously costly to businesses, so removing all the defects should enhance the image of the company that will be known for products that know no level of defects. Zero defects if it is to be realized can benefit the company in many ways The results of this paper are based on reading several papers and journals

about the issue of quality. However, as all branches of science, quality management witnesses everyday new ideas, perspectives, and critics of the old theories. Zero defects, Six Sigma, and other methodologies helped companies to save loads of money and to reach a better marketplace. However the pursue of improvement should never stop and pretty sure that in the near future, the field of quality management will embrace new procedures that will for sure overcome some of the technical and philosophical critics that the methodologies of today still have. And hopefully answer properly the question of “what is exactly quality? And how could it be improved?”

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