

Cost of Poor Quality Evaluation of the Effectiveness of “Zero defects” Goal in Quality Management

Rajaa TAIDI

National school of management. Tangier, Morocco

Mohamed Amine Mbarki

National school of management Tangier, Morocco

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.

I. 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. Also, the survey showed that around 60% of companies employ Six Sigma as the main tool to achieve quality. Six Sigma methods will be explained further in the literature review section. But in a nutshell, Six Sigma is a mathematical term that measures a process’ deviation from perfection; hence the main objective is to increase the quality of the final product by finding and eliminating the causes of defects. “Zero defects” is a philosophy of lean. It simply means that every single process should be designed in a way that can prevent the existence of defects and it perceives its existence as “bad quality.” The philosophy promotes the quest for perfection and that the achievement of zero defects within every single individual process will promote an increase in quality overall. The issue of the concept itself is open to debate. Some argue that the pursuit of such goal is not a good idea such as Deming (will be discuss further). And some like Crosby argue that zero defects is a must and that it is the mindset that businesses should adopt to reach quality. This paper is aiming at studying the differences between the two

perspectives regarding “zero defects” using the approaches of some quality gurus. In fact, the differences are not technical but rather philosophical in nature and the paper is going to focus on the paradigms and the subsequent intent that are imbedded in these approaches. My contribution will be to assess these differences and how Six Sigma with all the tangible benefits that benefited big companies like Motorola could be even improved if it is to take in consideration some issues that Deming had proposed in his philosophy; and how the assumptions that the “zero defects” have could be challenged to contribute better to the improvement of quality overall. This paper will contain a literature review that will explain thoroughly the different technical quality terms that will be in use, and it going to provide a fair explanation of the different quality trends, the different perceptions that the different quality gurus had concerning different issues, and how “zero defects” has been introduced to the world. The literature review will, hopefully, provide a solid ground to familiarize the reader with the topic before getting to the discussion part of the paper that will answer the research questions that will be mentioned at the end of the literature review.

II. 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, I will start 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, I will introduce the work

of Crosby who introduced to the world the philosophy of the “zero defects” (actually there is a debate on this matter since some people claim that Motorola came with the idea first). After explaining thoughtfully the concept, I 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.

A. 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.
- Work proactively to address the flaws in your systems and processes, which allow defects to occur.

B. INTRODUCTION TO 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. There is nothing new there. It includes what we used to call facilitators. They’ve adopted more flamboyant terms, like belts with different colors. 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.

C. 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).

D. DEMING PERCEPTION ON QUALITY AND ZERO DEFECTS 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. Organizations should always aim at developing and improving its products on a continuous basis. 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. His ideas were always focusing on systems and how they should reach continuous improvement in order to reach the ultimate quality management.

E. A BRIEF OVERVIEW OF THE TAGUCHI’S 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 $L(y) =$ Loss $k =$ constant = cost to correct tolerance² $y =$ reported value $m =$ mean value (average) (Taguchi On Robust Technology p. 22). But more is to be discussed about the Taguchi’s model in the discussion section. This literature review gave an overall view of some of quality management Gurus and how each one of them had contributed to the field and how they contradicted with one another. The focus of this paper is to study some specific areas of quality management and to answer some questions that are still debatable to this very day. Please find in the following section the research questions that I would like to answer using some of the terminologies introduced by the Gurus presented previously and some additional papers that will be presented later.

III. RESEARCH QUESTIONS

- Is “zero defects” a good motivational tool?
- Is the objective of “zero defects” and the defect oriented methodologies the answer to reach quality?
- Is “Six Sigma” a technical application of Deming’s philosophy or does it lack some profound knowledge points?

IV. METHODOLOGY

To answer the three research questions mentioned at the end of the literature review, I will use different type of analysis and tools since the questions differ in nature. I will include 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, 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. That why I had to analyze the fourteen points that Crosby implemented and understand what he meant exactly by “zero defects” in his “quality for free book”. Unfortunately I was hoping to have a Skype interview with the quality manager in order to cover more issues of how “company Tangier” deals with quality management but it could not be done due to shortage of time and his busy schedule. On the other hand, I was able to collect data from 23 surveys that were collected out of 30 and on the lights of the information given by employees I had some answers that will be discussed further in the “analysis” part of this paper. 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 paper it could be an added value that can check more or less what I have been reading on different papers about the issue. The second research question is of a philosophical nature in which I will try, 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, and I will try to use paradigms and subsequent intent of some vocabulary to criticize mainly the goal of “zero defects” and also “Six Sigma” that to an extent is an evolution or an advanced copy of what Crosby presented in his book “quality is free”. I will rely mainly on three main recourses. The first paper that I will refer to is “why I dislike the name Six Sigma” by Rafael Aguayo. 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”. I chose 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.

V. FINDINGS

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 as well, so 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.

Is “zero defects” a good motivational tool?

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.

VI. DISCUSSION

Is “zero defects” a good motivational tool? Before discussing further whether “zero defects” is a good motivational tool or not, one to mention that Crosby in his ideology mentioned in more than an occasion that “zero defects” is not a motivational tool. However, practices always dive away from what the theory originally suggests. This is why you can find to this day some companies that use slogans and banners calling for “zero defects” and calling forth its employees to try reaching

such goal. Zero defects in theory calls for “do it right the first time” kind of interpretation. A quote that I found in “lean software development an agile toolkit book” criticizes the goal of zero defects “one of the fastest ways to kill motivation is what is called in the US army a zero defects mentality. A zero defects mentality is an atmosphere that tolerates absolutely no mistakes; perfection is required down to the smallest detail. The army considers a zero defects mentality to be a serious leadership problem, because it kills the initiative necessary for success on a battlefield.” (Mary& Tom popperdieck).The quote is describing the effect of “zero defects” in military, but that could be applied to all fields since soldiers are human beings after all! **“Zero defects” kills motivation and create a great tension within an organization and among employees. It has several negative effects such as pushing employees to prefer diving away from taking important decision and taking instead decisions that could be less risky and that could be wrong sometimes.** That means that employing the concept in the business makes employees less empowered and discourages them from taking actions. Also, it makes them avoid responsibility and avoid being engaged in any complex or uncertain situations. Of course, the situation depends on the kind of industry the business is operating in. Some industries like test a new software, harder to define exactly in details, and even harder to predict possible mistakes. Last but not least, zero defects seems like it implies immediate compliance to a defect-free standards. And even if the business is to follow a defect oriented methodology (which is not the best thing to do as will be discussed shortly), it still eliminate the very idea of continuous improvement to actually occur. And it could actually even slow it down by de-motivating the employees. Relating the paradigms to the concept of “Zero defects”, the ultimate goal of businesses that focus on this methodology is to eliminate defects. In other words, the aim of quality management is to make sure that all the products are “acceptable” and “meeting the requirements”.

A. SIMILARITIES

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), the two views are not that different regarding the importance of defects. The logic of Six Sigma implies that defects reduce costs and improve profits at the end of the day, which is not that different from the “chain reaction” of Deming in which he calls for understanding the connection between defects, waste, and profits and how sales can drive the profit. However, as discussed before, Deming does not consider decreasing defects as increasing quality, but increasing quality can reduce defects instead. Yet, both pay special attention to defects and its danger of affecting business profitability.

B. DIFFERENCES

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.

VII. SUMMARY OF RESULTS

First research question tried to reveal the effectiveness of the “zero defects” goal. Actually the answer of this question, according to my humble opinion, is that such goal is a big management mistake if it is put in place as a motivational tool. According to all the readings that I have done, using “zero defects” as a motivational tool dive away from what Crosby originally implemented and shows a lack of understanding to what the methodology actually try to convey. Also, it shows that the management does not treat employees as actually a “working capital” but actually like an input that has to work in a perfect way so no mistakes are to be done. Concerning the small interview that I made (thanks to my contact in there). The third and fourth question had the same intentions and meant, in a way or another, the same thing, and yet mentioning “zero defect” implies perfection that creates right away a sense of uneasiness that drives motivation away. So as a result we can answer the question of “is “zero defects” a good motivational tool?” The second research question aimed at studying the effectiveness in trying to reach quality using “zero defects” and defect

oriented methodologies as an objective. To sum up, according to the paradigms, “zero defects” and all “defect oriented” theories miss the point, and do not opt for continuous improvement. As a result, seeking minimizing defects to reach quality is wrong and for methodologies that already scored success with multinational companies like “Six Sigma”, it could be even improved to reach better results.

VIII. 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 W.Edwards Deming were one of the earliest founders of what we call 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. However, several researchers did not agree with the methodology and one of them is Deming himself. According to Deming the goal is missing the point and opting for such goal as a methodology to follow in order to reach “quality” is not as effective as it should be. Six Sigma, another interesting methodology developed by Motorola, was able to get an enormous marketing value. Practitioners of Six Sigma are happy with the improvement levels and cost savings that the methodology managed to realize. However, is reaching profitability enough? Why would a business stop looking for new ways of improving even the quality of the “quality” methodologies? 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 I am 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?”

REFERENCES

- [1] Deming, W. E. (1986) *Out of the Crisis*, MIT Press, Cambridge, MA
- [2] Deming, W. E. (1983) *The New Economics*, MIT Press, Cambridge, MA
- [3] Taguchi, G. (1983) *Introduction to Quality Engineering*, Asian Press Organization

- [4] Arthur M.Schneiderman (2006), when is Six Sigma not Six Sigma?
- [5] Six Sigma, (2010, <http://www.isixsigma.com/>)
- [6] Albright, T.L (2002), *Managing quality through the loss quality function*
- [7] Joel Arthur Barker, *the business of discovering the future*
- [8] Management & Businesses portal, <http://www.mbsportal.bl.uk/>
- [9] Adam omasky A.M.ASCE, (2010), *Zero defect construction part 1- Worker motivation concept*
- [10] Quality Eline, *Six Sigma and beyond: Deming and Six Sigma*, <http://www.pqsystems.com/eline/2000/04/qualitytip.htm>
- [11] *Quality Digest* (2002) „Juran: A Lifetime of Quality”, *Quality Digest*, August 2002
- [12] Crosby, P. B. (1978) *Quality is Free – The Art of Making Quality Certain*, McGraw-Hill, New York, NY
- [13] David Wayne, *Deming management philosophy and So-called Six Sigma quality*
- [14] William J.Bellows, *conformance to specification, zero defects and sigma quality.*
- [15] Process Quality Associate, <http://www.pqa.net/>
- [16] Rafael Aguayo, *why i dislike the name Six Sigma* edited by Jordi Cabré
- [17] Philip H. Williams, “zero defects what it means? What does it achieve?”
- [18] Raphael L. Vitalo, (March 2005), *Six Sigma and Kaizen compared Part I*
- [19] Scott M. Paton, *four days with Dr. Deming* <http://demi>

AUTHORS’ PROFILES



Rajaa TAIDI was born in October 15, 1986 in Tetouan, North of Morocco. She is a PhD Student in Quality Management and logistics from the Moroccan National School of management in Abdelmalek Essaadi University at Tangier, Morocco. Her major research interests include the Study the poor quality Costs and its impacts on the logistics process performance.

She earned a specialized Master’s degree in transport and logistics. She received her bachelor in Management and economic sciences in 2007. Rajaa is a Resources planning supervisor at a Multinational company, she received her Black belt certification in “Process Excellence Lean six sigma” in 2014.



Mohamed Amine MBARKI is a Professor of Higher Education at the National School of Commerce and Management in Tangier, Morocco, Senior Consultant to the firm SMART PARTNER, Tangier, senior consultant for several organizations and consultancies with 21 years of professional experience. IRCA certified auditor.

Author of several scientific productions in the field of quality management. Qualified as Expert in the field of implementation of the quality approach by the Ministry of Employment and Vocational Training. Head of the research group “Management and Information Systems.” Former head of production planning and quality manager in an industrial company.