ORIGINAL RESEARCH PAPER

Management

SIX SIGMA BIBLIOGRAPHIC REVIEW

KEY WORDS: six sigma, quality, resources, customer

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ABSTRACT

Six sigma is a statistical method that management was initially implemented by the company Motorola in 1980, followed by AlliedSignal and General Electric. This methodology shows that all members of each company represent a major step in the implementation and development of processes; therefore everyone should learn about the skills needed to achieve the general and personal goals. The basis of Six Sigma is to teach everyone to be more effective and efficient, profitable companies to form and maintain satisfied customers with quality products without waste of resources, generating profits and jobs. The 6σ is a measure of satisfaction of the customer close to perfection, whose business performance is bad experiences 3.4 per million opportunities through DMAIC.

INTRODUCTION

Six Sigma has evolved from a quality indicator into an overall strategy to accelerate improvements and achieve performance levels, whose focus is directed towards the critical features for customers and identifying and eliminating the causes and process errors.

It is based on the allocation of achievable short-term goals aimed at long-term objectives, applicable both production activities as well as services. This strategy puts the customer first needs and expectations using facts and data to drive solutions in a process of continuous improvement. It focuses on defining customer satisfaction to continuously reduce defects per million opportunities (DPMO), the ideal number is 3.4 defects per million opportunities which is perceived as virtual perfection.

The Six Sigma efforts target three main areas: improving the satisfaction of the customer (giving the customer what he wants when he wants) and reduce the time of the cycle and reduce defects which produce large cost savings what allow retain customers and capture new markets. Achieve Six Sigma is an investment that will provide revenues to the enterprise; since, once reached Six Sigma virtually be operated without defects.

The novelty regarding the methodology of Six Sigma is that it involves the dissemination of knowledge of statistical methods at all levels of the company both technical staff and administrative resources to achieve improvements in processes resulting in a positive impact on the company and thus reduce variability and costs which results in an improvement in quality.

THEORETICAL FRAMEWORK

Six Sigma as a measurement standard in product variation can be traced back to the 1920s when Walter Shewhart showed that three sigma from the mean is the point where a process requires correction.

In the seventies, a Japanese firm took over a Motorola factory producing parts for televisions in the United States with the improved results defect was evident due to the recognition of quality defects.

Bill Smith in 1985, Motorola engineer produced a report in which he explained that if the products were developed Flawless achieved prevent the customer arrived to conditions that were not optimal (Moran, 2017).

Mikel Harry who also formed part of the quality of Motorola engineers made in four stages troubleshooting. Measure, Analyze, Improve and Control (ICAM), which became the roadmap to achieve Six Sigma quality.

Galvin in 1987 launched a program of long-term quality called "The Six Sigma Quality Program" which established six sigma as the skill level necessary to approach 3.4 defects per

million opportunities (DPMO) which should be applied to the entire company (products, processes, services and administration).

Galvin wanted zero defects in everything that was done to satisfy the customer. However, Motorola, Six Sigma was only a disciplined methodology for problem solving.

In 1988, Motorola was awarded to the Malcolm Baldrige National Quality Award.

Mikel Harry gave way to the training of those involved with the name that today are known; according to his abilities they happened to be black or green belt, like the oriental martial arts than he was loving.

In 1993 Harry joined Allied Signal. Larry Bossidy, CEO, decides to implement Six Sigma and involve all senior managers and leadership developed a methodology for selecting projects around statistical tools for troubleshooting.

Mikel Harry makes shocking data on the results of the application of Six Sigma, including: 20% improvement in the margin, 18% improvement in production capacity 12% reduction in the number of employees and 30% reduction capital needs.

Bossidy was invited by Jack Welch, CEO of General Electric, to share their experience with Six Sigma. General Electric conducted an analysis of cost-benefit in relation to the application of the methodology showing that if they were able to change a level of 3 to 4 Sigma, the estimated savings would move from 7 to 10 billion dollars, approximately 10 to 15 percent of its sales. That is why this method is adopted by General Electric in 1996.

There were two important contributions to General Electric contributed to the success and expansion of Six Sigma. The first paradigm demonstrate great leadership, without the support of senior management can not achieve victory. Second, Welch supported the Six Sigma program with a strong system of remuneration for the staff to show their commitment. Six Sigma became a prerequisite for moving up the corporate ladder of General Electric.

Six Sigma today represents the best tool for continuous improvement of quality processes, whether production or management. While you can not always make a full implementation by the idiosyncrasies of the company, achieve some projects or departments get its expansion to the rest of the company is irremediable (Moran, 2017).

3.1 Conceptualization

WHAT IS SIX SIGMA? Work philosophy and business strategy based on the approach to the customer with efficient management of data and methodologies, which eliminates variability in processes and achieve a level of less than or equal to 3 or 4 defects per million defects. (ARIAS MONTOYA, Porthole, & CHESTNUT BENJUMEA, 2008)

Philosophy Quality and Six Sigma: The philosophy of the Six Sigma recognizes that there is a direct correlation between the number of defects, waste costs and the level of satisfaction of the customer. Six Sigma statistically measures the ability of the process to operate free defects or failures. (ARIAS MONTOYA, Porthole, & CHESTNUT BENJUMEA, 2008)

Working strategy:

The process of improving the Six Sigma program is developed based on:

STAGE 1: DEFINE

Also called concept development. It is about knowing each process, activity and people working on it to be sure of the process to follow (ARIAS MONTOYA, Porthole, & CHESTNUT BENJUMEA, 2008).

PHASE 2: MEAS - IDENTIFY

Choose one or more critical features, the process is analyzed, the necessary measures are taken, records the results, evaluates measurement systems, and the ability to process the short term (ARIAS MONTOYA, Porthole, & CHESTNUT BENJUMEA, 2008) is estimated .

PHASE 3: ANALYZE - COMPARE

Performs an analysis to explore and give a diagnosis of the problem from the information obtained in the measurement phase. It factors that achieve a substantial improvement and better performance of the process (ARIAS MONTOYA, Porthole, & CHESTNUT BENJUMEA, 2008) are identified.

PHASE 4: IMPROVE - IMPLEMENT

all strategies for improvement bases in practice. Factors defined that are to be monitored to measure the effect on the critical features and optimal way to develop a process (ARIAS MONTOYA, Porthole, & CHESTNUT BENJUMEA, 2008) is planned.

PHASE 5: CONTROLLING

Documenta the result of the improvement, and tools are designed to monitor the process once they have achieved the goals for improvement (ARIAS MONTOYA, Porthole, & CHESTNUT BENJUMEA, 2008).

In applying the Six-Sigma in the analysis of industrial processes can quickly detect problems in production and bottlenecks, product liability, waste of time and critical stages is why it is very important this methodology. (Lopez, S / F)

To achieve Six Sigma, certain parameters should be used (total quality control, zero defects, ISO-9000 procedures and statistical techniques). The methodology of the Six-Sigma allows comparisons between businesses, products, processes and similar or different services. It provides tools to know the level of quality of the company and the same time provides direction to the growth objectives of the company. (Lopez, S / F).

For proper Six Sigma implementation using certain tools quality improvement, such as required:

a) *Process Flow Diagram*; with which the steps of the process are known by a sequence of steps and critical stages. (Lopez, S / F)
b) *Diagram of cause-effect*; It is used as brainstorming to detect the causes and consequences of problems in the process. (Lopez, S / F)
c) *Pareto;* It is applied to identify the main cause of problems in process-Low and thereby reduce or eliminate one by one (starting with the higher and then later or to be more accessible). (Lopez, S / F)
d) *Histogram*; with which data (flaw defect) are observed and grouped into Gaussian containing the lower and upper limits and a central tendency. (Lopez, S / F)
e) *Graph Run*; It is used to represent data graphically over time, to detect significant changes in the process. (Lopez, S / F)
f) *Graphic Control*; It applied to keep the process according to an average value and the upper and lower limits. (Lopez, S / F)
g) *scatter diagram*; with which you can relate two variables and obtain an estimate of the usual correlation coefficient. (Lopez, S / F)
h) *Regression Model*; It is used to generate a model relationship between a response and an input variable. (Lopez, S / F)

1. METHODOLOGY

A literature review was conducted using database as Google

Scholar, Scielo, Science Direct; keywords were used as six sigma six sigma making combinations with the conjunction Y (AND) and disjunction O (OR), included also terms such as methodology, Six Sigma, Six Sigma, process, philosophy, management, equipment, companies , quality, lean, six, sigma.

For the selection of publications studies they were included observational, literature reviews, systematic reviews. The quality of the items was assessed by STROBE for observational studies; Based on the selected items described initially generalities about six sigma, objectives, concluding with the results, discussion and conclusions.

2. RESULTS

For the presentation of results; teams of the SIX SIGMA - 6ტ are competent to handle the main technical tools (tree critical for quality, process diagram, histogram, Pareto chart, summary sheet analysis process, diagram of cause and effect, scatterplot , affinity diagram, run chart, control chart) and they are able to improve performance, efficiency and help stakeholders to accept solutions that promote continuous improvement (Eckes, 2008).

Based on the application the results of the 6ტ are represented using different tools ("light") is not mathematics or statistics in tables or similar representations of these analyzes concerned fail to verify, describe, analyze strategies planning Continuous improvement according to the following tools:

Analysis Chart interesados.- it is applied directly to a group or person you need to deploy the solution on a computer, showing two things, the first sample where the interested party is currently the second makes a projection of where it should be the stakeholders (Eckes, 2008).

Box planning for influencia.- diagnosed type of resistance and underlying reasons for the gaps found, developing strategies to overcome it.

Oportunidades.-

threat matrix and helps create needs for solutions, providing answers to the questions being one of the threats of the current process and occurs if the solutions (Eckes, 2008) are implemented.

Beneficio.-

matrix is implemented in the analysis phase where it proceeds to check root cause (softening, reducing or eliminating the causes) dividing into two easy or hard axis, according to the hierarchy (Eckes, 2008).

Statement prevista.- solutions convinces stakeholders of the need for a series of planned solutions; similar to an array of threats and opportunities, it is to be differentiated specifically verifying their involvement based on their behavior (Eckes, 2008).

Agenda of the meeting held at a time equipment.- six to four months where decisions are made tangible effectively and efficiently taking into account the elements, results, methods, and responsible person assigned time (Eckes, 2008).

Rules básicas.- are those preconceived ideas and obtained from the mind open to the whole team, to discuss, to be useful to apply consensus on negative surveys to be suggested these basic rules of how to do the job and these should be discussed and adopted (Eckes , 2008).

The estacionamiento.- the leader of the team encarrilla the position taken by someone from the team negatively discussing issues that these described are not found directly on the agenda being in a painting subject "parking" the decision they take to the lift section (Eckes, 2008).

Assessment of pros and cons in each reunión.- simple but effective technique that after each meeting is to be evaluated with the pros of the content cons of the content, method pros, cons of the method (Eckes, 2008).

Activities.- report is that document which is responsible for how it is organized, raises and controls the steps of the work according to the DMAIC activities according to their respective validation and verification (Eckes, 2008).

The tools presented are divided into two groups the first 5 are those that provide greater acceptance in the solutions generated by the team and 5 second increase dynamics agenda effectively adopted due to the basic rules accepted their respective use of the called "parking" (Eckes, 2008, p 147).

3.DISCUSSION

The concepts most successful described Six Sigma as a methodology for solving problems by following a sequence of steps known as DMAIC (define, measure, analyze, improve and control) and as a measure which is used sigma and defects per million opportunities. These two meanings are combined to form a system of quality management of identifying needs and expectations of the consumer, which in turn are transformed into requirements for the product or service offered and ultimately become specifications that determine their quality.

It is necessary to establish an objective value, an upper specification limit and a lower setting out a specification range based on the objectives set by the customer, the high command of an organization or the market demand for products or processes. The number of sigmas in this range determines the quality; the higher the number of sigma, higher quality and lower defects per million opportunities (Luis Garcia and Villarreal, 2014).

It is important to establish control limits which are indicative of the variation in performance of a process, they reflect the actual values that the process is operating; Six Sigma seeks to reduce the interval between the control limits to minimize performance variability and improve the effectiveness, efficiency and corporate profitability.

One of the most common mistakes is to confuse the terms "defects per million opportunities" and "defects per unit". Defects per unit allows us to measure defects of a product in its entirety. Defects per million opportunities measured defects of a product taking into consideration each of its parts (opportunities). This determines that the more complex a product will be more difficult quality control, hence this strategy emphasizes process improvement(Luis Garcia and Villarreal, 2014).

No deployment models. That is why despite the success of companies like Motorola and General Electric have demonstrated from the application of Six Sigma in its management, there are many organizations abandoned this strategy.

In 1990 Geoff Nicholson, 3M representative attributed the disastrous results of his company's production was due to the implementation of Six Sigma kill her responsible for innovation 3M (Bartok, 2019).

The failure or success of Six Sigma does not depend on their content; but its application. It is a strategy that requires commitment to the high command to allocate appropriate resources and training for implementation; It involves maintaining a good relationship and communication with employees who the reasons, advantages and results are

expected to explain the application of six sigma processes, to encourage their participation and commitment to the development of this management model. Training is essential personnel to form master black belts, black belts, green belts to lead and execute Six Sigma projects; management, selection and prioritization of projects are also relevant, and identifying the objectives of the project and the steps to be followed to achieve them according to the needs and expectations (requirements) of the target population. Clearly there are multiple conditions and high level of demand to be established to ensure the success of six sigma (Antony and Banuelas, 2002)

4. CONCLUSIONS

Six Sigma has evolved from its focus on the field of manufacturing to involve all business processes that have a direct effect on the client.

Six Sigma seeks quantifiable returns. For a project to be approved it is important to determine its ultimate impact (Antony, 2004, p.2).

The success of Six Sigma is an indirect reflection of the leadership of top management and its ability to positively influence the mindset of workers passing on the importance of establishing a management system that limits the number of errors in processes to meet consumer demands and improve the profitability of the organization.

Because it promotes the reduction of defects by methods of reducing the variability of the process based on proven tools and statistical techniques it is considered a complex strategy that involves training of all personnel working in the organization.

Six sigma is not 100% replicable as there are companies that do not have the fully qualified personal failure in implementation.

The application of any quality management system has an implicit risk. According to Mikel Harry is not possible to obtain interim profits, so meditate on the need for its implementation is vital to avoid bad results and especially if its correct implementation is feasible to achieve the desired success.

ATTACHMENTS

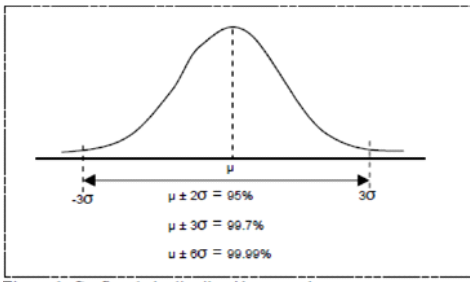

Figura 1. Grafica de la distribución normal

(ARIAS MONTOYA, Porthole, & CHESTNUT BENJUMEA, 2008)

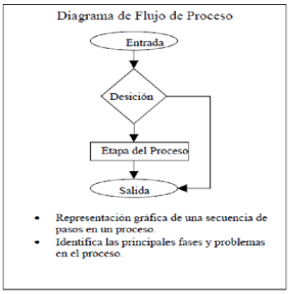

Figura 1. Diagrama de Fluio de Procesos.

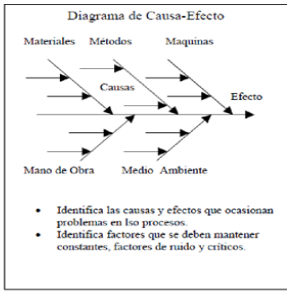

Figura 2. Diagrama de Causa-Efecto

Figura 3. Diagrama de Pareto

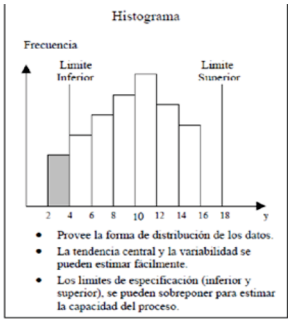

Figura 4. Histograma

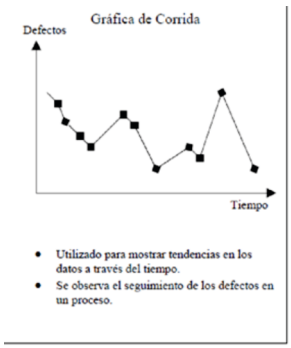

Figura 5. Gráfica de Corrida.

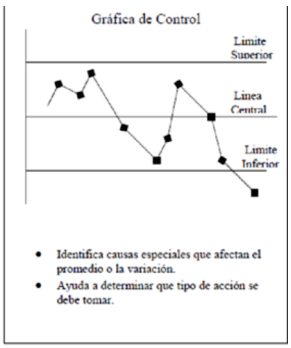

Figura 6. Gráfica de Control.

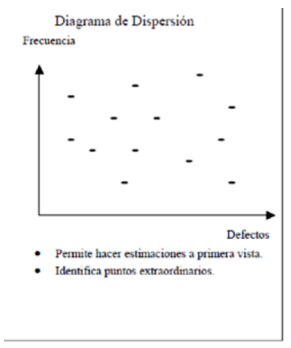

Figura 7. Diagrama de Dispersión

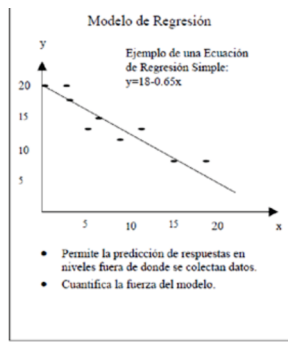

Figura 8. Modelo de Regresión

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