

REFINING THE CONCEPT OF LEAN SIX SIGMA

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Abstract- This paper provides a comprehensive literature review on the concept of Six Sigma and Lean Thinking. The paper is aimed at defining the methodologies of the two concepts, and discusses how the concepts have been used previously and the results that they have yielded. The concept of Six Sigma has been in existence for some while now, and although the concept was originally restricted for use in the production and manufacturing industry, it has been applied in many other industries since its inception with immense successes. Similarly, the concept of lean thinking has been used across many industries with success stories. The aim of this paper was to refine the knowledge of the two concepts make a comparison and clarify any misinformation that may be out there regarding the concept. The paper has reviewed several papers written about the concept that are reference in the paper. It is expected that the study will give guidance to practitioners and make it easy for them to make use of the concept. The paper also provides insightful information that makes interesting items for further research.

Index Terms- Lean Thinking, Six Sigma, Lean Six Sigma.

I. INTRODUCTION

Six sigma is an approach used in business processes to improve their performance and enable organizations to improve their provision of services, boost confidence that customers have in the Organization, as well as boost the operations of an organization [1]. The original approach was made for use in manufacturing applications at Motorola, although really the idea was advanced and well demonstrated by General Electric, through their financial services business. Over the time, manufacturers that have used the approach have reported substantial success, even though many manufacturers have tended to be slower in embracing the approach for use in their key transaction processes and operations. Many of the manufacturers that have reported these successes point at the huge amounts of money saved and the huge unexploited potential for customer satisfaction attributable to the improvements in the business transactions and in the manufacturing processes as well [2]. Six Sigma is an approach that is improvement oriented, seeking to perfect processes that there are fewer mistakes, and translating to consistency in profitability and delivery of outputs, to the requirements of the customers, with only room for only 3.4 error for every million chances. This is very high performance would ordinarily be a requirement for entry for sensitive businesses where safety is a major concern, although implementing such an approach would also greatly improve delivery of services and customer satisfaction even when dealing with mundane and vital services such as giving customer feedback and responding to customer calls.

II. BACKGROUND TO THE STUDY

Arguably, Six Sigma is the best among other quality approaches. This can be attributed to the stringent measures and efforts aimed at identifying customer needs, and using the needs to specifically address the

problems. Compared to other quality approaches, Six Sigma stands out. In this approach, there is also strong emphasis on management, to ensure that organizations rely more on facts and verifiable data other than falling to the temptation of relying on the opinion and customer experiences which could be confusing, contradictory and misleading [2]. The approach is also focused on the real problems relevant, and that affect the customers as well as the business and ensuring that solutions are provided in way that meets the business needs as well as those of the customers. Over time, the use of Six Sigma for improving quality of service and customer satisfaction has been growing at an exponential rate. This can be attributed to the fact that Six Sigma offers a realistic and disciplined approach aimed at improving the effectiveness of service. Traditionally, the approach has been used in the manufacturing industry, although emerging and competitive financial industries that have an a eye for distinction have continuously taken up the approach motivated by the zeal to increase revenues, by improving efficiency couple with the resulting rise in customer numbers as a result of customer satisfaction [1].

III. OBJECTIVES

The objectives of this study are:

1. To refine the understanding of Lean Six Sigma,
2. To define and appreciate Lean Six Sigma methodology,
3. To correct the wrong assumption of Lean Six Sigma, and
4. To make a comparison between Lean Thinking against Six Sigma.

IV. LEAN SIX SIGMA

Lean Six Sigma is a fusion of two programs for improving quality in businesses, namely Six Sigma

and Lean Thinking. Therefore it is important to understand the two programs separately for any conclusive study.

Table 1: Six Sigma and Lean Thinking

PROGRAM	SIX SIGMA	LEAN THINKING
Theory	Reduce Variation	Remove waste
Application Guidelines	1. Define	1. Identify Value
	2. Measure	2. Identify Value stream
	3. Analyze	3. Flow
	4. Improve	4. Pull
	5. Control	5. Perfection
Focus	Problem focused	Flow focused
Assumptions	A Problem exists	Waste removed will improve business performance
	Figures & numbers are valued	Many small improvements are better than system analysis
	System output improves if all variations are removed	
Primary effect	Uniform process output	Reduced time flow
Secondary effects	Less waste	Less variation
	Fast throughput	Uniform output
	Less inventory	Less inventory
	Fluctuation performance measures for managers	New accounting system
	Improved quality	Flow performance measure for managers
		Improved quality
Criticisms	System interaction not considered	Statistical or system analysis not valued.
	Processes improved independently	

Source: [5].

V. SIX SIGMA

Simply put, Six Sigma is a method used to efficiently solve problems, as using the approach increases the chances of reducing defective products, resulting in increased levels of revenue and more customer satisfaction. The name Six Sigma is derived from a concept in statistics when in a process where a million products are produced, only 3.4 would be defective. Six Sigma can then be viewed as a goal, where fewer defects are encountered in a process with consistency, thus reducing variations, so that products and services are delivered in more reliable manner [1]. Sigma capability is used to measure the ability of a production process to be flawless. In the manufacturing process, a defect is used to mean a dissatisfied customer. When measuring Sigma, it is necessary to have a clearly define customer needs, as having clear picture of the customer needs helps an organization to know what processes are significant and require improvement. If companies focus on the problems and the problem opportunities, then through the use of Sigma, it is possible to compare various processes in the Organization and sometimes even in other organizations. This way, when defects are identified, improvements can be made. Once such have been identified, the opportunity area and requirement, organizations have the ability to identify

and the errors and the level of avoidance of errors that such a company intends to reach [1]. When using Six Sigma, the focus is mainly on reducing the variations in the processes, and hence solving the problems of the business. This is possible because by using statistical methodologies, it is possible to detect the faults and fluctuations through the process, thus making it easy for the management to make predictions on the outcome. The methodology of Six Sigma has a number of connotations which are necessary for organizations to understand why it is very important to become a Six Sigma organization:

- “Six Sigma is an enterprise process, which enables companies to improve their final results, design, and surpasses their usual activities, minimizing waste and resources and increase customer satisfaction.
- It allows enterprises to reduce the number of defects in all their outputs and eliminate quality error.
- The Six Sigma methodology not only enables errors to be detected and corrected, but it also contributes methods to create new processes, which ensure that the error does not occur again.
- The Six Sigma is a business strategy, which seeks to identify and eliminate causes of error or defects or failures in business processes by focusing on outputs which are critical to the customer” [2].

A. Six Sigma Methodology

The concept of Six Sigma originated with Engineer Mike Harry from Motorola, the engineer, influenced the organization through observing variations in production processes and focusing on improving them. The variations, are statistically known as standard deviations which are presented by Sigma (σ) a letter in the Greek Alphabet. Emphasis on the variation was also channeled to continuously improve the process, so that as little as 3.4 defects can be achieve for every million products, a situation that can only be defined as near perfect [1]. The approach mainly targets reducing the variations in the production process, which leads to process improvement and increased capability. To achieve this, Six Sigma uses two models of improvement, namely: DMAIC and DMADV.

(a). DMADV

DMADV - Define, Measure, Analyze, Design and Verify. This procedure is for the most part utilized for item outline before assembling. The DMAIC methodology is utilized to refine the assembling process through decrease of what is known as common cause variation. The DMADV methodology is intended to eradicate the disparity between what the customer needs and what was actually designed. The DMADV strategy ought to be executed when an administration or item needs to be grown in an organization where does not as of now exist or it has not achieve the particular sigma level. The periods of DMADV are:

- Define the venture objectives and customer deliverables.
- Measure and focus customer needs and prerequisites.
- Analyze the procedure to meet the customer needs.
- Design (point by point) the procedure to meet the customer needs.
- Verify the outline execution and capacity to address customer.

(b). DMAIC

DMAIC is the model used to refine the process of manufacturing so as to reduce common variations. The model has five phases:

Define; here, practitioners begin by defining the process, usually by enquiring from their customers what their problems could be. The aim is to figure out the necessary features that customers consider significantly, together with the production processes that support the features. In this phase, conditions of the output as they exist are also identified, along with the elements of the process.

Measure; after the defining phase, the focus in this phase is on the measuring process, where the key characteristics identified are categorized. At the same time, the verification systems for measuring measurement systems is done along with collection of relevant data.

Analyze; after data collection, analysis follows. Analysis of data enables raw to be converted into a format which it can be understood and usable to provide process insight, identification of the causes for the defects.

Improve; in this phase, improving the process is the most important in this step. It is here where problems are solved with making necessary adjustments to the process. At this point also, the company can make judgment as to whether the changes benefit the company or not, to make further changes.

Control; at this point if the processes performance is satisfactory, then the process is adopted. In this stage as well, the process is also monitored as way of ensuring that there are no unexpected changes.

The design performance and its ability to meet customer needs can be verify by these two methodologies, whereby DMAIC is a methodology used to improve an existing system, whereas DMADV is used for the design and development of new initiating processes or product [4]. However, the literature shows that any organization can customize these methodologies according to their needs.

B. Contribution to the process

In the Six Sigma methodology, focus is specifically on reduction of variation, although it has secondary effects, which lead to improvements in the quality of products. Changes in the production process adds value to the products as they are modified while some faulty documents are discontinued.

Six Sigma reduces errors and reduces any chances for errors. However, it is possible to have some elements

identified in the course the investigating the process, which influence the flow of the process. Flow is usually defined "as the time from the input of raw materials to the output of a saleable item" [1]. Organizations also benefit from having less money being held up in the in-process inventory. This can be attributed to the reduction of the time of flow, and therefore the organization is in a position to address customer demands faster.

Six Sigma is operates on two assumptions, first, that staff involved in the Organization would embraced and conceptualize the figures depicted in six sigma could represent features and processes. The assumption also holds that people within the organization are in a position to synthesize and understand the data, and that data if well analyzed the process would improve significantly. Six Sigma also assumes that through reducing variations in the processes of production, then performance in the entire Organization would be achieved automatically. This assumption does not always necessarily hold as sometimes variations would negatively influence the process.

VI. LEAN THINKING

Lean thinking is a system that focuses mainly on removing waste in the production process. "Waste" is generally defined as elements that do not necessarily lead to production of a product or service [7]. According to Paul [6], Lean Thinking is a methodology for improving cycle times and quality through the elimination of waste. It is also known as Lean Manufacturing, when used in manufacturing applications, and the Toyota Production System, due to its origins. It has one common measure, which measures the time a product is touched by a worker. The process entails 5 steps. **Identify Value:** this is the first step which deals with determining the features that create significant value for products. This determination is made out of investigation leading to gathering information from customer information. Product value is usually an expression of the manner in which specific products meet specific requirements of the customer at a particular price offered at the time. Product evaluation is based on the specific aspects add value, from the perspective of a customer or the process that follows the production [3]. **Identify Value stream:** after the value identification, the specific activities that contribute to value are identified. This of course leads to identification of the entire process and activities. After the activities that create value have been identified, their contribution to the products is determined. The activities that are necessary are grouped and separated from those that are not. From this determination, necessary operations are defined as an essential part of the business. **Improve Flow:** after activities that add value as well those the necessary activities that not add value are grouped and identified, efforts to improve the process are made to make the

process fluid. Allow customer pull: after removing the unnecessary activities and establishing flow, focus is directed towards allowing customers to pull the products through the process. The business at this point adapts the process towards making it respond, and able to provide a product only when needed by the customer. Working towards perfection: The corrected process is redone severally with attempts aimed at eliminating any non-value activities, improve flow and satisfy the customers. Like Six Sigma, Lean Thinking operates on some assumptions: that people appreciate the effect of the activities that “waste” is the most significant restriction to profits, that minute improvements following each other closely benefit the process more, and that the process effects can be solved in the sequences of activities. These assumptions are not necessarily true.

CONCLUSION

Simply put, Lean is a set of tools aimed at reducing waste associated with the flow of materials and information, in a process, from the start to the end. Lean is aimed at identifying and eliminating steps in the process that are not essential and do not add any value to the process, so as to make the production process as hassle free as possible, improve quality and increase customer loyalty. Lean Six Sigma is born of the push to combine the two approaches so as to gain from the synergies of both. When combined, Lean Six Sigma in way magnifies the strengths of both approaches, at the same time minimizing the weaknesses of the two approaches. Lean Six Sigma puts emphasis on the removal of waste, through the use of Lean tools to speed up the process, and then the use of Six Sigma tools and methods to reduce process variation. Even though Lean and Six Sigma are distinct methodologies, they are related as they both have some shared tasks all geared to improving

efficiency and quality in the production process. From the foregoing discussion, the Lean Six Sigma is a very important methodology for quality improvement as it has been used previously to streamline the operations of a company and increase its profitability, reliability, growth and customer satisfaction. The concept is one of the surest ways to turn around companies. The paper has comprehensively discussed the fact that Lean is a Toyota production system, while Six Sigma is a Motorola concept. Lean’s methodology is more inclusive; allowing everybody to take part in improvement efforts, while on the hand Six Sigma uses experts more, and is more complex approach compared to Lean which uses more basic and common approaches. However, despite the clear distinction between the two approaches, the concept of LSS can be defined as a brand-new Six Sigma with a few tools of Lean added.

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