



Implementation of Lean Six Sigma in Indian Manufacturing Industries

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Introduction : The concept of Six Sigma was developed in 1986 by Motorola as a set of tools and techniques to improve the processes. In 1995 this concept was used by Jack Welch as the main concept of the business strategy of General Electric which is used by a number of industrial sectors these days.



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Six Sigma identifies and removes the defect causing elements along with reducing the changeability of the business and manufacturing processes to improve the quality of outputs of a manufacturing process. In this methodology, a set of quality management methods is used to create within the organization for a special infrastructure of the people who can use these methods like experts. An organization follows a defined set of steps to quantify the targeted value of the project while using each project of Six Sigma. For instance the organization can reduce pollution, reduce time cycle of a process and reduce cost of production for increasing profits and satisfaction level of its customers.

The Lean Approach

- Like Six Sigma, Lean is a tool used by businesses to streamline manufacturing and production processes. The main emphasis of Lean is on cutting out unnecessary and wasteful steps in the creation of a product so that only steps that directly add value to the product are taken.
- As far as Lean methodology is concerned, the only way to determine if something has value or not is to consider whether a customer would be willing to pay for it. Any part of the production that does not add value is simply removed from the equation, leaving a highly streamlined and profitable process in place that will flow smoothly and efficiently.



- Lean is a production practice with the key tenet of preserving value with less work. Operations that fail to create value for the end customer are deemed "wasteful." Eliminating waste and superfluous processes reduces production time and costs.
- The seven wastes listed by Japanese founders Toyota are transport, inventory, motion, waiting, overproduction, over-processing and defects. The tools for implementation include value stream mapping, kanban pull systems and poka-yoke (mistake proofing).
- Lean's mantra of "doing things better" leads many companies to view it from a cultural standpoint. Think of it like recycling – for it to work, it has to be more than an arbitrary process, and actually be engrained in society. For Lean to be successful, it has to permeate the business silos and receive universal backing amongst senior management and employees.

In lean Six Sigma, there are five principles that are used:

- 1) The first of these is the law of the market. This signifies that the customer is always to be put first. The company must implement this immediately and make sure that all employees adhere to it. The company wants the employees to understand that without the customers, there would be no business.
- 2) The second of these principles is the law of flexibility. If a process is easily maneuverable, it is easier to work with. A method of business that cannot be changed for any reason can cause problems.
- 3) The third principle is the law of focus. This is meant to keep the focus on the problems within the company and not the entire company itself. Executives and employees should concentrate on just the portions of the company that are causing problems and fixing those problems, dismissing distractions by other areas of the business that are not having problems.
- 4) The fourth principle is the law of velocity. This means that if a process has many, many details that have to be performed, it may be slowing down the process. The work put into the process should be proportional to the results the company sees.
- 5) The fifth principle in lean Six Sigma is the law of complexity. Simply put, keep it simple. When a process is complex and difficult, it may have elements that are not



necessary. More complexity does not necessarily mean more valuable or more important. In fact, it could mean just the opposite.

Comparing Six Sigma and Lean System

Essentially, Six Sigma and Lean systems have the same goal. They both seek to eliminate waste and create the most efficient system possible, but they take different approaches toward how achieving this goal. In simplest terms, the main difference between Lean and Six Sigma is that they identify the root cause of waste differently.

Lean practitioners believe that waste comes from unnecessary steps in the production process that do not add value to the finished product, while Six Sigma proponents assert that waste results from variation within the process.

Review of Literature

Six Sigma is a business strategy that helps organizations to improve their operations, enhance quality, eliminate defects and thus increase profits (Thawani S, 2004). Many of the well-known companies all over the world doing business in different sectors have benefited enormously by adopting Six Sigma business approach. Six Sigma identifies and resolves chronic problems that directly impact the bottom line of an organization. Embarking on a Six Sigma program means delivering top-quality products and service while virtually eliminating all internal deficiencies.

Six Sigma is not just about statistics but rather based on the scientific method, utilizing statistical thinking (Snee, R D and R W Hoerl, 2003). It is an overall business improvement initiative rather than just a quality initiative. The main theme of Six Sigma is identifying defects and eliminating them to less than 3.4 defects per million opportunities (DPMO). It defines, measures, analyses, improves and controls the vital few processes linking the improvement of quality directly to the bottom-line results. Up till now, Six Sigma approach has been usually associated with large OEM companies because of their financial strength and manpower resources, because of which, there is a perception that Six Sigma is applicable only for large companies possessing better resources.



The implementation of this project has been considered as successful because the critical factor for the process were found and controlled. (Adan Valles¹, Jaime Sanchez¹, Salvador Noriega², and Berenice Gómez Nuñez¹ 2009) Therefore the control plan was updated and new operating conditions for the production process. The base line of the project was 3.35 sigma level and the gain 0.37 sigma that represents the elimination of 1.88% of nonconforming units or 18,788 PPM's. Also, the maintenance preventive program was modified to achieve the goal stated at the beginning of the project. It is important to mention that the organization management was very supportive and encouraging with the project team. Finally, Six Sigma implementation can be helpful in reducing the nonconforming units or improving the organization quality and personal development.

Six sigma has evolved into a powerful business improvement methodology in many Indian industries and its importance is growing. (Chandrakala Sao^{1*}, Dr. Sridhar K², 2015) This paper presents that the concept of Six Sigma, DMAIC methodology is used to implementation of Six Sigma especially for manufacturing industries and also some factors that are acting as a barriers for adoption of Six Sigma by manufacturing industries have been discussed. This paper describes the methodology, implementation and benefits of Six Sigma. At last some topics for future research are presented.

In Iron Ores Industry, manufacturing process capability is an important factor for business continuity. (Sri Indrawati, Muhammad Ridwansyah, 2015) There are some problems faced in manufacturing process that caused inability to fulfill the manufacturing quantity target. In order to improve the manufacturing process capability, this research is conducted using lean six sigma method. The first part is focused on waste analysis using process activity mapping. Then manufacturing process capability is evaluated. Further, failure mode and effect analysis is used as a basic consideration in developing the continuous improvement program. The research shows that the quality performance is in the level of 2,97 sigma. There are 33,67 % non value added activity and 14,2% non necessary non value added activity that occurs during the manufacturing process. Based on the analysis, product defects, inappropriate processing and waiting are type of manufacturing waste that frequently occurs.



While many business gurus may have identified one or more of these Six Sigma basics as important to the successful (William H. Gaw, 2016) pursuit of business excellence, the fundamental importance of these basics seems to have been lost in the proliferation of buzz words and the mania of systems sophistication. It is time for companies to put a hold on sophisticated systems development that cause self-inflicted, day-to-day chaos. In its place, they should initiate an action learning program for gaining a company-wide understanding and acceptance of the importance of the basics of Six Sigma. Once buy-in and commitment have been achieved, aggressive planning and tenacious implementation must follow. In short, that is putting “horse in front of the cart.” And such a program will build a solid foundation for redefining and revitalizing a company’s pursuit of profitable growth.

Reduction of waste’ has been key theme of ‘lean’ concept implementation in manufacturing, process and up to some (Sanjay Kumara, Sunil Luthrab, Abid Haleemc and Dixit Garg , 2014) extent in service sectors of industries; however, ‘six-sigma’ concept implementation focuses upon ‘quality improvement techniques’ in production and delivery of products/services. ‘Lean six-sigma (LSS)’ concept combines tools and techniques of ‘lean’ and ‘six-sigma’ towards achieving enhanced benefits to gain competitive advantage. Implementation of LSS concept has been emphasized in this paper by addressing identification of appropriate enablers and ranking of these enablers. Literature review and subsequent discussions with experts enabled to: identify; sort and combine; and finalize twelve enablers important to implement ‘lean six-sigma’ concept. Analytical hierarchy process (AHP) has been used to rank identified LSS enablers by utilizing experts’ opinions. ‘Management involvement and funds allocation’ has been rated as top ranked enabler to implement LSS concept. Decision making authorities may be benefitted in dealing with planning and implementation of ‘lean six-sigma’ concept in manufacturing and service sectors.

Despite its popularity, Lean Six Sigma often fails to deliver. (Peter Guarraia , 2008) Manufacturers are finding upfront diagnostic X-ray improves their odds of streamlining operations and cutting costs. As a methodology for improving both factory output and quality, Lean Six Sigma (LSS) has gained widespread popularity. The approach, which aims to help companies create lean manufacturing operations and boost product quality to no more than 3.4



defects per million opportunities, has delivered significant improvements and cost savings at companies as diverse as General Electric Co., Dell Inc., Xerox Corp., and Johnson & Johnson.

Employee Involvement

The Six Sigma approach uses teams to develop and apply solutions to specific problems in the production process. Through training and tests, employees earn martial arts belt rankings - - white, yellow, green and black - - to signify their Six Sigma knowledge and skill levels. The exclusive teams, which include members of different rankings, form to work on a finite project and disband when the work is done. Other employees, who are not involved in the process, wait to receive the information about changes and implementation. Lean Six Sigma includes the methodology and teams of traditional Six Sigma and also incorporates the lean philosophy of continuous improvement.

Lean Six Sigma engages the entire company in efforts to create a culture of learning and continuous improvement. The company expects each employee to continuously build his knowledge and skills, participate in identifying and resolving problems and integrate the lean philosophy to reduce waste throughout the company. A small company with limited staff could have problems implementing a team approach. Lean Six Sigma's inclusiveness can create a higher level of cohesiveness and accountability in a small company.

Approach

Six Sigma teams use a methodology called DMAIC, which is an acronym for “determine, measure, analyze, implement and control.” The team works in isolation to develop, apply and test any solution.

Lean Six Sigma rejects the “front-loading” method of decision-making in favor of making decisions based on observation. Workers engage in “knowledge creation” through short learning cycles, which reveal problems and solutions through observation. The observational method allows for continuous tweaking of the process and improved results in attaining goals. A small business could use both methods for different purposes. A Six Sigma team can address a serious issue that needs close attention for quick resolution, while a company maintains Lean Six Sigma as its permanent method for organizational improvement.



Goals

Six Sigma's structured application of the DMAIC components helps teams deliver a measurable level of improvement in the process. Improvement is reflected in the attainment of the Six Sigma goals: decreased cost, fewer defects and improved quality.

Lean Six Sigma's company-wide improvement approach operates within the concept that waste can always be found in the system, so the method requires continuous efforts to reach the goal of improved customer satisfaction through streamlining the processes, increasing speed and improving quality. Broad organizational goals for Lean Six Sigma include enhanced organizational sustainability, increased profit and improved employee morale. A small manufacturing business can use the elements of Six Sigma to improve production values or implement Lean Six Sigma in a department such as accounts payable or inventory control to achieve common goals through collaboration with the manufacturing facility.

Implementation

The training, analysis and planning required to implement Six Sigma, traditional or lean, can seem like an overwhelming challenge for a small business with limited resources. Implementation of either program becomes a problem if the processes overwhelm your small company with too much work, such as requiring employees to provide too much information too frequently.

You can implement lean principles throughout your small business in preparation for adoption of the more complex Six Sigma or Lean Six Sigma program. A small business can plan a staggered implementation of Six Sigma, beginning with one area that needs improvement, while employees get up to speed with training. A company that implements Six Sigma or Lean Six Sigma needs to commit at least one employee to oversee and drive the process, undergo formal training in the programs and train other employees. Outside help, such as Six Sigma experts and temporary workers, can get your company started in either improvement program with minimal disruption to daily operations.



Conclusion :

Many businesses have initiated a process improvement program to improve quality and productivity, with the goal of increased profitability. In recent years, two of the more popular programs of this type are Lean and Six Sigma. ‘Lean six-sigma (LSS)’ concept combines fundamentals, principles, tools and techniques of ‘lean’ and ‘six-sigma’ to gain competitive edge over competitor organizations/supply chains by achieving ‘reduction of waste’ by implementing ‘lean’ concept in manufacturing, process and service sectors and ‘quality improvement’ by implementing ‘six-sigma’ concept. Therefore, ‘Lean six-sigma (LSS)’ concept has been used to achieve enhanced benefits to gain competitive advantage. Identification of appropriate enablers (Management involvement and funds allocation; Culture with Effective communication; Training and change management; Project management and LSS techniques (Statistical Thinking); Linking LSS to business strategies; Customer Integration; HRM, employees’ motivation and team management practices; Supplier involvement; Manufacturing facilities, standardization and scheduling; Visual control; Floor layout and optimization of transportation & material Handling; Reliable data collection and retrieval system) of ‘lean sixsigma’, twelve in numbers, has been carried out by reviewing suitable literature and followed by ranking of these enablers using analytical hierarchy approach utilizing experts’ opinions. “Management involvement and funds allocation”, “Floor layout and optimization of transportation & material handling”, “Linking LSS to business strategies” and “Manufacturing facilities, standardization and scheduling” have been rated top four ranked enabler towards implementation of ‘lean six-sigma’ philosophy in Indian manufacturing industry.

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