

Lean Manufacturing through enhancing Productivity

A Review Paper

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Abstract— Use of the term “Lean”, in a business or manufacturing environment describe a philosophy that incorporates a collection of tools and techniques into the business process to optimize time, human resources, assets and productivity, while improving the quality level of products and services to their customers. Productivity is also the impact of peoples working together. Machines are merely an extended way of collective imagination and energy. Lean manufacturing is one of the most used method for continuous improvement of business. Organization management philosophy focuses on the reduction of wastage to improvement of overall customer value. Keep in mind that Lean applies to the entire organization.

Index Terms— Productivity, Lean manufacturing, Production cycle, Lean thinking.

I. INTRODUCTION

Henry Ford is known as “Father of the Management”, continued his focus on waste minimization while developing his mass assembly manufacturing system and work standardization. While standardizing the work, each activity is analyzed on the basis of desirable activity or undesirable activity. All the desirable activities are known as value added activity and undesirable activities are known as wastes. Thus work standardization has become the basis of Lean thinking.

Lean thinking is an approach to achieving manufacturing excellence based upon the continued value addition and elimination of waste. Lean thinking is a set of methodologies for maximizing value of an item or feature for which a customer is willing to pay. All other items aspects are deemed waste.



Fig.1 Lean terminology

Lean production and Lean maintenance- utilizes techniques and principles that improve efficiencies of value, product development, operations, suppliers and customers relations that requires less human effort, less space, less relations that requires less human effort, less space, less capital and less time to make products with fewer defects compared with the previous system of mass production. Lean maintenance- Maintenance works that is to be carried out by application of TPM, 5S, Kanban and Andon with less waste, less human effort, less maintenance space, less investment in tools, less inventory, and in less time. TPM is a lean tool to optimize the effectiveness of equipment and tooling.

Lean Manufacturing – Lean Manufacturing is a way to eliminate waste and improve efficiency in a manufacturing environment. Lean manufacturing was successfully implemented by Toyota in his factory hence named as Toyota production. 1 Taiichi Ohno identified wastes as - Elimination of waste is the goal of Lean. Toyota defined three types of waste-

- i. Muri – Muri focuses on the preparation and planning of the process or what can be avoided proactively by design.
- ii. Mura- Mura focuses on implementation and the elimination of fluctuation at the scheduling or operations level such as quality and volume.
- iii. Muda- Muda is after the process is in place and is dealt with reactively. Taiichi Ohno identified seven types of wastes in operational working. These are-
 - 1) Overproduction – Production ahead of demand.
 - 2) Transportation- Moving products that are not actually required to perform the processing
 - 3) Waiting- Waiting for the next production step.

- 4) Inventory- All components, work-in-progress and finished product not being processed.
- 5) Motion People or equipment moving or walking more than is required to perform the processing.
- 6) Over processing – Due to poor tool or product design creating activity.
- 7) Defects- The effort involved in inspecting for and fixing defects.

II. LITERATURE REVIEW

According to Karlsson & Ahlstrom (1996), the ultimate goal of implementing lean manufacturing in an organization is to have the customer in focus when improving productivity, enhancing quality, shortening lead times, reducing costs etc.

Dankbaar and Ben (1997) stated that the lean manufacturing makes optimal use of the skills of the workforce by giving workers more than one task, by integrating direct and in direct work, and by encouraging continuous improvement activities.

William (2001) expressed that, the five primary elements to present the various facets required supporting a solid lean manufacturing programme, namely manufacturing flow, organization, process control, metrics and logistics.

Robert (2002) reported that a better definition of lean manufacturing is that it is a manufacturing philosophy to shorten lead times and reduce costs by reducing waste and improving organizations performance, employees skills, and customers satisfaction.

According to Alukal and Manons (2002), a planned implementation of lean production system leads to improved quality, better cash flow, increased sales, better productivity, improved morale and higher profits. They further reported that companies earned greater benefits by implementing lean techniques in the office functions in non-manufacturing organizations too, such as banks, hospitals, restaurants etc.

Bicheno (2004) reported that the lean manufacturing is a philosophy, not a system or a technique. It is about simplicity, flow, visibility, partnership and value.

Narain and Yadav (2004) define the “Since the advent of economic liberalization in the early nineties the manufacturing scene in India has witnessed major upheavals. Reeling under the heavy burden of stiff international competition, Indian manufacturers throughout the country has now begun to place greater reliance on their own strengths to harness the latest technologies available, and to pursue the best management practices followed elsewhere in the world in an attempt to become lean and agile”.

Jorn (2009) suggested that the numerous case studies have been showing examples for the successful implementation of lean principles in different areas of corporate enterprises.

Kapuge and Smith, (2007) says that “The increase in competition has led to an increased focus on customer satisfaction as a survival of the company in the long run”

Er. Manoj Ade & Dr. V.S.Deshpande says to that Lean philosophy is the only way of reduction of waste and improves effectiveness of the resources to complete the world. Identification of wastes is a continuous and never ending process, with the application and implementation of lean production the cost can be produced with highest quality at cheaper rate.

Upadhye et al. (2010) studied the importance of small and medium scale industries in Indian context. Medium size manufacturing industry plays an important role in Indian economy. Their contribution to the economic development of the nation is indeed significant. But the productivity level of these industries is quite low as compared to other country.

Palaniappan (2010) described the performance and benefits of small scale manufacturing industry in India. Small scale industries form an important sector constituting 40% of the total output to the private sector and much more significant is the employment generation capacity of small scale sector.

Chauhan et al. (2010) shows the problem to sustain in global market for an organization. Lean manufacturing is a hymn of survival and success of any organization. The goal of lean manufacturing is to minimize all types of waste so cost of the product can be reduced.

Hudli and Inamdar (2010) described the development of key areas which could be used to assess the adoption and implementation of lean manufacturing practice also presented some of the key areas developed to evaluate and reduce the most optimal project so as to enhance their production efficiency.

Lucas et al. (2010) focused on implementation of lean on small manufacturer of all 4-wheel drive vehicles, through implementation of basic lean tool, the small manufacturer rapidly increase output and reduce quality defects by 80%.

Khedkar et al. (2012) worked on implementation of 5S on plastic moulding industry. 5S is used in small industry and also showed the advantages and benefits of 5S.

P. M. Rojasra & M. N. Qureshi (2013) explains the concept & methodology if implementing 5S. This paper discusses a case study applied in plastic industry and get significant results by implementing 5S.

III. METHODOLOGY

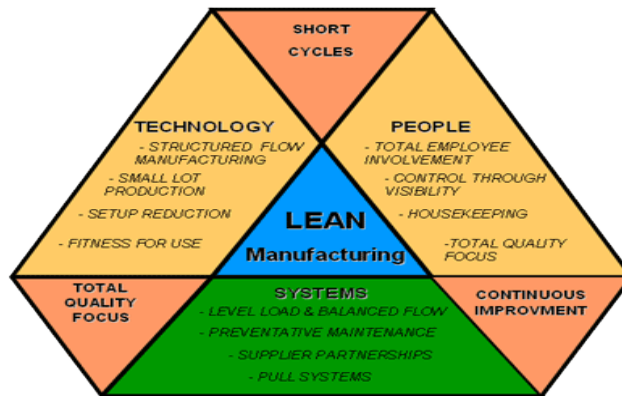


Fig.2 Methodology of Lean Manufacturing

In order to reduce or eliminate the above wastes, Lean practitioners utilize many tools. Successful practitioners recognize that, although most of these may be implemented as stand-alone programs, few have significant impact when used alone.

Pull System – The technique for producing parts at customer demand. Service organizations operate this way by their very nature. Manufacturers, on the other hand, have historically operated by a Push System, building products to stock (per sales forecast), without firm customer orders.

Kanban – A method for maintaining an orderly flow of material. Kanban cards are used to indicate material order points, how much material is needed, from where the material is ordered, and to where it should be delivered.

Work Cells – The technique of arranging operations and/or people in a cell (U-shaped, etc.) rather than in a traditional straight assembly line. Among other things, the cellular concept allows for better utilization of people and improves communication.

Total Productive Maintenance – TPM capitalizes on proactive and progressive maintenance methodologies and calls upon the knowledge and cooperation of operators, equipment vendors, engineering, and support personnel to optimize machine performance. Results of this optimized performance include; elimination of breakdowns, reduction of unscheduled and scheduled downtime, improved utilization, higher throughput, and better product quality. Bottom-line results include; lower operating costs, longer equipment life, and lower overall maintenance costs.

Total Quality Management – Total Quality Management is a management system used to continuously improve all areas of a company's operation. TQM is applicable to every operation in the company and recognizes the strength of employee involvement.

5S or Workplace Organization – This tool is a systematic method for organizing and standardizing the workplace. It's one of the simplest Lean tools to implement, provides immediate return on investment, crosses all industry boundaries, and is applicable to every function within an organization. Because of these attributes, it's usually our first recommendation for a company implementing Lean.

Visual Controls – These are simple signals that provide an immediate and readily apparent understanding of a condition or situation. Visual controls enable someone to walk into the workplace and know within a short period of time (usually thirty seconds) what's happening with regards to production schedule, backlog, workflow, inventory levels, resource utilization, and quality. These controls should be efficient, self-regulating, and worker managed, and includes kanban cards, lights, color-coded tools, lines delineating work areas and product flow, etc.

Concurrent Engineering – This is a technique of using cross-functional teams (rather than sequential departmental assignments) to develop and bring new products to market. In many instances, implementing concurrent engineering has reduced time-to-market by 50%. The automotive and computer industries are good examples.

Kaizen-Kaizen was created in Japan following World War II. Kaizen is a combination of two Japanese words (kai + zen), literally means "change for the better". This is translated as "continuous improvement" in English. The creator of the Kaizen or Continuous Improvement was the late Dr. W. Edwards Deming, an American statistician. The concept of Kaizen focuses on improving a work space of an organization in step by step improving process and eliminating waste.

Poka-yoke- It is a human mistake proofing. System of means eliminating defects being the results of inaccuracy; poka-yoke solutions find application in stable processes and enable to drop of frequency of defects for six sigma level.

Jidoka (Autonomation)-Control process held, one of the basic solutions improving assurance of the quality production, defects of the processed part are automatically found by the machine, which immediately stops its working mode

IV. THE BENEFITS RESULTING FROM LEAN MANUFACTURING SYSTEM

- Increased overall productivity
- Reduced amount of floor space required
- Reduced manufacturing lead time
- Improved flexibility to react to changes
- Improved quality

V. CONCLUSION

From the literature, it can be concluded that there is a great literature available on application of lean manufacturing system, which gives a broad view of past practices and researches carried out across the globe. Lean manufacturing are widely accepted philosophy in manufacturing industries and also more research work is required in this field. Today, many large manufacturers are demanding that suppliers adopt lean practices. Lean organizations are able to be more responsive to market trends, deliver products and services faster, and provide products and services less expensively than their non-lean counterparts. Lean crosses all industry boundaries, addresses all organizational functions, and impacts the entire system – supply chain to customer base.

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REFERENCES

- [1] James P. Womack, Daniel T. Jones & Daniel Roos (1994). *The Machine that Changed the World: How Lean Production Revolutionized the Global Car Wars*. New York: Simon and Schuster
- [2] S. R. Devadasan, Sivakumar, R. Murugesu & P. R. Shalij. *Lean and Agile Manufacturing: Theoretical, Practical and Research Futures*. PHI Learning Private Limited, New Delhi.
- [3] Alukal, G., & Manos, A. (2002). *How Lean Manufacturing Can Help You Mold Shop- By Incorporating Lean Manufacturing into Doing Ope*. Feature Article. [Online] Available: <http://www.moldmakingtechnology.com/articles/1002004.html>. (Retrieved From Internet: 24/4/07)
- [4] Karlsson C & Ahlstrom P, "Assessing changes towards lean production", *International Journal of Operations and Production Management*, Vol.16, No.2, pp.24-41, 1996.
- [5] Dankbaar T and Ben K, "Lean Production", *Journal of Human Relations*, Volume 50, Issue 5, p.33, 1997
- [6] William M. Feld, "Lean Manufacturing: Tools and Techniques", Published by the educational Society for Resource Management, Virginia, p.101, 2001.
- [7] Robert C. Creese P.E., "Cost management in lean manufacturing enterprises", *Proceedings of the fourth SME International Conference*, held at West Virginia University, USA, p.01, 2002.
- [8] Bicheno J., "The New Lean Toolbox: Towards Fast, Flexible Flow", First Edition, Published by PICSIE Books, Buckingham., p.33, 2004
- [9] Chauhan et al., "Measuring the status of Lean manufacturing using AHP" *International journal of Emerging technology* vol.1 no.2, pp.115-120. 2010.
- [10] Lukas et al. "Lean implementation in a low volume manufacturing environment: A case study" *Proceedings Industrial Engineering Research Conference* (2010)
- [11] Hudli and Imandar, "Areas of Lean manufacturing for productivity improvement in a manufacturing unit", *world academy of science, engineering and technology* vol. 69, 2010.
- [12] Upadhye et al. "Lean manufacturing system for medium size manufacturing enterprise: An Indian case" *International journal of management science and engineering management*. Vol.5, no. 5 pp. 362-375, 2010.
- [13] Khedkar et al. "Study of implementing 5S techniques in Plastic Moulding" *International Journal of modern engineering research*. vol. 2, no 5, pp. 3653-3656, 2012.
- [14] Er.Manohar Ade & Dr.V.S.Deshpande, "Lean Manufacturing and Productivity Improvement in coal mining Industry." *International Journal of Engineering Research and Development*. Vol. 2, issue 10(august 2012), pp. 35-43.
- [15] Jorn Hoppmann, "The Lean Innovation Roadmap", PhD thesis, Technical University of Braunschweig, p.19, 2009.
- [16] Narain, R., & Yadav, R.C. (2004). *Productivity Gains from Flexible Manufacturing*. *International Journal of Operations and Production Management*, 53, (2), 109-128.
- [17] P. M. Rojasa, M. N. Qureshi, "Performance Improvement through 5S in Small Scale Industry: A case study". *International Journal of Modern Engineering Research*. Vol. 3, Issue. 3, May - June 2013 pp-1654-1660