International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

IMPLEMENTATION OF LEAN MANUFACTURING TOOLS IN INDIAN MANUFACTURING INDUSTRIES: A REVIEW

Khemraj Patel [a], Rinkey Sahu [b]

[a,b]Department of Mechanical Engineering, RSR Rungta College of Engineering and Technology, Bhilai-490024 Chhattisgarh, India.

A B S T R A C T

LMS was successfully employed to improve crusher hammer manufacturing productivity or output. The LMS tools; such as value stream mapping, single minute exchange of die, and Kaizen were employed to reduce the setup time of drill machine. The improvement, especially in drill machine was achieved through Kaizen (continuous improvement) targeting design and work method changes. The specific innovative design changes or improvements made in the drill machine to reduce the setup time included the application of work table modification. Other benefits were obtained through reduction of work-in-process inventory, which in turn reduced the shop floor congestion and improved workplace safety. The data recorded through the survey across the core machine tool manufacturers have been analyzed, and the results are presented. The results show that the status of lean implementation in the machine tool sector is still in infant stage. The reasons for low priority towards lean practices among the industries have been identified, and suitable measures have been suggested to address the problems. This will further assist the machine tool industries to gauge their level of leanness and will serve as a foundation for future research.

Keywords: LMS, Manufacturing, Kaizen, VSM.

Introduction

At the end of 1890, Frederick W Taylor became the first to study work management scientifically and distribute the results. His work led to the formalization of time and motion studies and the setting of common standards. Frank Gilbreth then added the concept of breaking work down into elementary time blocks. It was around this time that the first notions of eliminating waste and studying movement began to emerge. In 1910, Henry Ford invented the assembly line for his standardized Ford Model T. Alfred P. Sloan improved on Ford's system when he introduced the concept of assembly line diversity at GM. After the Second World War, Taiichi Ohno and Shingeo Shingo created the Just In Time, Waste Reduction and Pull System concepts for Toyota, which, together with other flow management techniques, resulted in the Toyota Production System (TPS). By the 1950's the Toyota Production System was well into development, and Toyota was beginning its journey to out compete the rest of the world with regard to producing reliable quality cars.

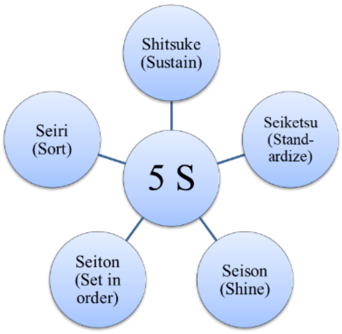

Figure 1. 5 S Model

Lean manufacturing can be defined as a systematic approach to continuously identify and remove the wastes from the system. Lean manufacturing philosophy is one of the most important concepts that help businesses to compete and for achieving excellence. Lean manufacturing or lean production, simply known as lean, is a production practice, which regards the use of resources for any work other than the creation of value for the end customer, is waste, and thus a target for elimination.

SMED is one of the most desirable lean manufacturing tools used to reduce the setup time of a machine. The SMED basically focuses on reducing setup time by converting all internal activities into external activities and simplifying internal and external activities. Internal activities are those activities that need the stoppage of machine, whereas external activities are those that do not need the stoppage of a machine and can be done while the machine is being used for production. SMED technique also suggests the use of one touch mechanism like one touch screw and one touch holder to reduce the setup time further. The SMED project should be implemented in four phases. In the first phase, the whole setup procedure should be analyzed.

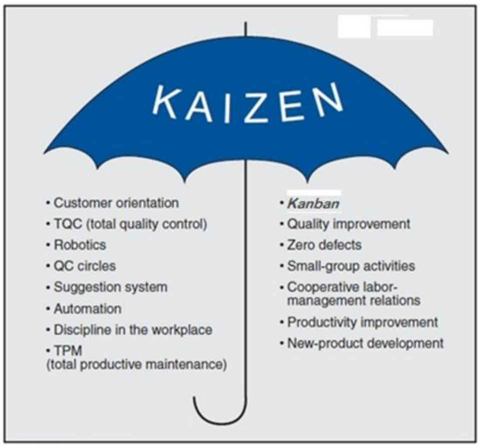

Figure 2. Kaizen

Literature Review

Lean manufacturing (LM) is a multi-dimensional management practice including just in time, quality systems, work teams, cellular manufacturing, supplier management, etc., in an integrated system. The core motivation of lean manufacturing is that these practices can work synergistically to produce finished products at the pace of customer demand with little or no waste. The characteristics and impacts brought by lean practices have been presented in a number of works [1], [2]. It is demonstrated in the Japanese automotive industries as Toyota Production System (TPS) [3].

TPS allows the continuous improvement of a business through the relentless elimination of waste, or non-value-added activities. Waste, in TPS, is defined as anything that does not add any value to the product or service from a customer's perspective [4]. There are seven types of fundamental wastes defined in TPS as correction, overproduction, motion, material movement, waiting, inventory, and processing [5]. To eliminate these wastes, TPS uses tools such as workplace organization, visual communication and control, quick changeovers, pull system, error proofing, etc. [6]. Further, features of a typical LM model include: single piece flow production, non-value-added time elimination, production in the work content time only, relocation of required resources to the point of use, and leveled production by all the processes at the Takt time [7].

Pavnaskar has studied and organized a total of 101 lean manufacturing tools to serve as a link between manufacturing waste and lean tools to assist companies in lean transition [8]. The successful application of various lean practices had a profound impact in a variety of industries, such as aerospace, computer and electronics manufacturing, forging company, process industry (steel), and automotive manufacturing [9], [10]; as a matter of fact, some industry may already be using some of the methodologies without actually realizing it. A study of the literature indicates that survey-based lean assessment work has been carried out in Australian manufacturing industry [11], electronics manufacturing [12], Spanish ceramic tile industry [13], and Malaysian electrical and electronics industry [14]. In light of the above findings, the present study is the first attempt that explores the degree of use of lean practices in machine tool industry and provides direction for future research.

McDonald et al. [15] applied value stream mapping (VSM), enhanced by simulation, in a manufacturing plant. They have strongly suggested that simulation can be used to enhance the utility of VSM. VSM is prescribed as part of the lean tool kit and has been applied in a variety of industries. In this paper, we also describe an application of VSM in order to identify the various forms of waste to a dedicated forging flow line. In this research, the authors have successfully mapped Taguchi's method of parameter design in lean environments. In the last decade, numerous research works showing the effectiveness of Taguchi's method have been published in various journals. However, its application to achieve leanness in a forging environment has rarely been addressed. In the upcoming sections, we have illustrated our research approach in a lucid manner.

Lean manufacturing system (LMS) is a philosophy or concept that aims to improve productivity and reduce waste. Lean manufacturing endeavors to use less of everything: less investment in equipment and tools, less manufacturing space, less workers, and less engineering time in product and process design [16]. The reduction of waste can be in inventory or resources such as manpower, equipment, or floor space. Examples of waste reduction include the reduction of process defects, less scrap, and low inventory.

Vinodh et al. [17] maintain that sustainable benefits can be obtained from reduction of work-in-process, elimination of potential waste from damaged products and lesser floor space utilization. The objective of lean manufacturing is to reduce waste in terms of waiting time, setup time and work-in-process (WIP) inventory [18]. Waste specially in the context of the manufacturing environment or company means redundant application of resources that does not contribute value to the product, for which the customer is unwilling to pay. Some of the manufacturing wastes are overproduction, WIP inventory, finished parts inventory, inappropriate processing, transportation, defects, and scrap [19]. The implementation of lean manufacturing philosophy or concept in the various manufacturing sectors has been documented in the literature in recent years. The analysis of case studies dealing with the application of lean manufacturing can be found in steel production [20], aerospace manufacturing [21], electronic manufacturing [22], automotive production [23], [24] and aircraft manufacturing.

Patnayak et al. [25] combined lean manufacturing with cellular layout to improve the efficiency of ammunition components manufacturing. The present investigation was conducted at large scale industry of India, engaged in manufacturing coal crusher plate. The main objectives of this investigation were to, 1) present an overview of LMS; 2) state the relevant information about the manufacturing plant, product, and processes; and 3) implement a lean manufacturing system to improve productivity of coal crusher plate manufacturing at large scale industry.

Liker and Meier [26] highlighted the danger in using VSM like a cookbook. At Toyota, people spend years working on improvement projects before they reach the status of new on STP (segmenting, targeting, positioning). There is a lot to learn, and it is only possible to learn by doing. One LM principle is continuous improvement. According to Shingo, improvements in production systems are likely to be constructed from two points—new ideas and rethinking of the basic ones. The Toyota model is a cyclical process of achieving stability, standardization of practices, and placing continuous pressure on the process to expose its obstacles. Value stream mapping, a lean manufacturing tool, which originated from the TPS, is known as “material and information flow mapping.” This mapping tool uses the techniques of lean manufacturing to analyze and evaluate certain work processes in a manufacturing operation. This tool is used primarily to identify, demonstrate and decrease waste, as well as create flow in the manufacturing process. VSMs can be created merely using paper and pencil; however more advanced maps are created using Microsoft Visio as well as Microsoft Excel. Below you can see an example of a very basic VSM created with Microsoft Visio. Martins and Laugeni highlight the importance of continuous improvement, where no day can pass without the company doing better in the market. VSM plays a key role in mapping a process, identifying wastes, and making improvements.

Kumar and Manoj analyze the various obstacle encountered during implementation of lean manufacturing in Indian manufacturing industry and status of LM tools implemented. But author does not discuss about the reason behind the low priority towards the adoption of lean manufacturing, in this work additional to these suggestions were provided to Indian managers. A survey was conducted across the India to understand the working environment, support from top management and which LM tools they were implemented and benefits obtained [27].

Conclusion

This project work deals with implementation of lean manufacturing system (LMS) to improve productivity of crusher hammer manufacturing at large scale industry and to find out the obstacles encounter during implementing lean manufacturing techniques. Crusher hammer is one of the most important products of machine shop which is manufacture in bulk for coal crushing plant. So there is a need of improving productivity by eliminating waste. The following problems are identified in existing industry.

1. To present an overview of LMS.
2. To focus on value adding activities and to increase percentage value addition.
3. To reduce waste in terms of setup time and work-in-process (WIP) inventories with appropriate method like VSM, SMED and kaizen design and suitable suggestions.
4. To adopt most valuable Lean Manufacturing tools.
5. To analyze the reasons behind low priority toward the lean-ness and barriers.
6. To provide a guidelines to Indian managers to establish a clear sense of direction for lean manufacturing and open communication and continuing education

REFERENCES

[1] Womack JP, Jones DT, Roos D (1990), The machine that changed the world. Rawson, New York

[2] Shah R, Ward PT (2007) Defining and developing measures of lean production. International Journal Operation Management 25:785–805

[3] Monden Y (1983) Toyota Production System. Industrial Engineering and Management Press, Norcross

[4] Ohno T (1988) Toyota Production System: beyond large scale production. Productivity, Portland

[5] Shingo S (1992) The Shingo prize production management system: improving process functions. Productivity, Cambridge

[6] Liker JK (2003) The Toyota Way: 14 management principles from the world's greatest manufacturer. McGraw Hill, New York

[7] Pattanaik LN, Sharma BP (2008) Implementing lean manufacturing with cellular layout: a case study. International Journal Advance Manufacturing Technology 42:813. doi:10.1007/s00170-008- 16298

[8] Pavnaskar SJ (2001) Developing a structured tool set for lean product development. Master of Science Thesis, Michigan Technological University, Houghton, Michigan.

[9] Mac Duffie JP, Sethuraman K, Fisher ML (1996) Product variety and manufacturing performance: evidence from the international automotive assembly plant study. Management Science 42:350–369

[10] Houlahan CJ (1994) Reduction of front-end loading of inventory: making the airframe industry lean through better inventory management. Massachusetts Institute of Technology, Cambridge

[11] Liker JK (1998) Becoming lean. Productivity Press, Portland

[12] Doolen TL, Hacker ME (2005) A review of lean assessment in organizations: an exploratory study of lean practices by electronics manufacturers. J. Manufacturing System; 24(1):55–67

[13] Tomas B, Antonio MJ (2006) An empirical study of lean production in the ceramic tile industry in Spain. International Journal Operation and Production Management edition; 26(27):505–531

[14] Wong YC, Wong KY, Ali A (2009) A study on lean manufacturing implementation in the Malaysian electrical and electronics industry. International journal of science and Research 38(4):521–535

[15] McDonald T, Van Aken EM, Rentes AF (2002) Utilising simulation to enhance value stream mapping: a manufacturing case application. International Journal Logist: Res Appl 5(2):213–232

[16] Nickels WG,McHingh JH,McHugh SM, Berman PD, Cossa R (2008) Understanding of Canadian business, 4th edition. McGraw Hill, Toronto

[17] Vinodh S, Arvind KR, Somanaathan M (2011) Tools and techniques for enabling sustainability through lean initiatives. Clean Technology Environment Policy 13:469–479

[18] Sohal AS, Egglestone A (1994) Lean production: experience among Australian organizations. International Journal Operation and Production Management 14 (11):35–51

[19] Monden Y (1998) Toyota production system: an integrated approach to just-in-time, 3rd edn. Engineering and Management Press, Norcross

[20] Abdul Malek FA, Rajgopal J (2007) Analyzing the benefits of lean manufacturing and value stream mapping via simulation: a process sector case study. International Journal Production Economics;107(1):223–236

[21] Bamber L, Dale BG (2000) Lean production: a case study of application in a traditional manufacturing environment. Production Planning and Control, 11(3):291–298

[22] Chan FTS, Lau HCW, Ip RWL, Chan HK, Kong S (2005) Implementation of total productive maintenance: A case study. International Journal Production Economics 95:71–94

[23] Krishnan PV, Vijaya RB, Pillai MK (2011) Work-in-process optimization through lean manufacturing. International Journal Econ Res. 2(2):19–25

[24] Soderquist K, Motwani J (1999) Quality issues in lean production implementation: a case study of a French automotive supplier. Total Quality Management 10(8):1107–1122

[25] Pattanaik LN, Sharma BP (2009) Implementing lean manufacturing with cellular layout. International Journal Advance Manufacturing Technology 42:772–779

[26] Liker JK, Meier D (2005) Toyota Way Fieldbook. McGraw-Hill, New York

[27] Kumar, Manoj (2013), Adoption of Lean Manufacturing in Indian Automotive Industry:An Analysis, IUP Journal of Mechanical Engineering.