ISSN: 0971-1260
Vol-22-Issue-17-September-2019

Lean Kaizen in Sme Using Value Stream Mapping To Improve Quality

Bhupinder Singh[1*], Sunpreet Singh Grewal[1#], Dr. Jagdeep Singh[2]

[1*,1#]School of Polytechnic, Lovely Professional University, Phagwara-144411, Punjab, India,
[2] IK Gujral Punjab Technical university, Kapurthala.

Email: [1*]bhupinder.16993@lpu.co.in, [1#]sunpreet.16001@lpu.co.in

ABSTRACT

Lean-Kaizen is consisted of two sayings the LEAN and the KAIZEN; Lean means eliminating insignificant exercises and Kaizen implies persistent improvement; thus lean-kaizen focuses to eliminate the waste by implying small improved changes. Lean-kaizen is a technique of improvement handles wide range of inadequacies in the manufacturing plants. It gives a superior opportunity to everyone in the organization to participate in continual improvement processes in achieving the goals or targets decided by the organizations in an economic manner.

In this study, VSM, a lean tool has implemented which provides a conceptual vision by designing future state map of a series of processes of product through analysis of current state map. The processes contributing more in waste creation are recognized by assessing the takt time. The focus is made on resolving daily routine complications such as quality rejections by applying lean principles and Kaizen philosophy through performing the effective and efficient case study in Indian small and medium scale enterprises (SME) manufacturing majorly 'Spindle Kick Starter' for two wheelers (Bajaj Pulsar). The process of identifying root causes of daily basis problems has achieved through why-why analysis that provided pertinent and fertile evidences in finding and applying Kaizen in targeted areas. The data obtained were evaluated before and after the introduction of VSM and it is concluded that Lean-Kaizen is an efficient and cost-effective method for achieving steady improvement in SMEs.

Keywords: Lean-Kaizen, Quality Management System, Problem solving techniques, Lean Manufacturing

1. INTRODUCTION

The primary focus of the employees during training is to develop skills, learning new concepts, the factors responsible for changes in the organizations and helps to solve the problem in the organizations [13]. These techniques were most realistically used in the Japan to primarily demonstrating their commitment towards steady improvements and achieving global keenness as compared to others till 1980 [5]. Kaizen is a well-known system or practice that pertains to expel flaws in any company [23]. Kaizen is a word origin from Japan, combines of two words for example the KAI and the ZEN. The word 'KAI' signifies 'Persistent' and 'ZEN' signifies 'Improvement'. By and large, the Kaizen implies as 'Change for the Betterment' or 'Persistent Improvement' [7][9] which is first introduced by Masaaki Imai. Kaizen refers as result of small improvements made by continuous efforts and commitment from all level of management [19-21]. Kaizen embraces the umbrella term

ISSN: 0971-1260
Vol-22-Issue-17-September-2019

of eliminating waste in process, which focus on the process improvement. This provides a basis for lean manufacturing (LM), which mainly aimed at the persistent improvement [19-21][6]. Kaizen is a Japanese philosophy and process-oriented approach that focuses on incremental improvement. Kaizen is the crucial element of the lean thinking [24]. Today's so called LM and Kaizen principles are firstly understood and explained by Henry Ford. As the two sides of the same coin, he noted both standardization and development likewise. At every opportunity seeking to lower waste, lessen uncertainty, cut cycle times for the process and enhance overall efficiency, the notions of LM and Kaizen were applied constantly. Various tools alike Poka Yoke, Visual controls, One-piece flows, Value-Stream Mapping (VSM), Cellular manufacturing's, managing inventories, Calibration of work, reducing the scrap and waste to organize workplace were utilized to plummeting wastes in processes in manufacturing organizations [2][23][22]. In this study, VSM, a lean tool has implemented which provides a conceptual vision by designing future state map of a series of processes of product through analysis of current state map. The processes contributing more in waste creation are recognized by assessing the takt time. The daily routine quality problems tackle at shop floor has solved by applying Lean-Kaizen concept. The root causes have identified by why-why analysis that provided pertinent and fertile evidences in finding and applying Kaizen events in targeted areas. The data obtained were evaluated before and after the introduction of VSM and it is concluded that Lean-Kaizen is an efficient and cost-effective method for achieving steady improvement in SMEs.

2. LEAN-KAIZEN IMPLEMENTATION: CASE STUDY

The methodology has been implemented to XYZ Industries, located in focal point area of Ludhiana (Punjab) in India, who are manufacturing the auto parts like Sprocket, Plain Collar, Spindle, Spindle Kick starter (product used as spindle kick for bike named Pulsar), gear selector that supplies to bike and car manufacturers. A case study has been performed by application of VSM tools on SKS taken into contemplation to improve production, quality, on time delivery performance and to lessen costs keeping LM principles. Using well-defined images, VSM is granted [19-21]. The pencil and paper tools are used for mapping VSM using process symbols to visualize info, data and movement of the raw-material during manufacturing. The Lean-Kaizen methodology includes the several steps; data collection and problem identification, preparing current VSM, predicting future VSM, Takt time calculations, brainstorming process and proposed Kaizen, performing Kaizen Events, result and conclusion.

3. RESULT AND DISCUSSION

3.1 Data Collection and Problem Identification

Data Collection plays a major role in finding any problem. In the present case study, the set of date has been obtained from the in-process quality records, final inspection reports and the record available with the PPC department. The observation has been made by closely comparing an average of three months record of the in-process and final inspection quality data; It has been identified that the steps formed on the outer diameter of the SKS is contributing majorly i.e. 48% to overall problems after analysing the rejections using pareto diagram for rejections.

ISSN: 0971-1260
Vol-22-Issue-17-September-2019

3.2 Preparing Current CSM

CSM refers to the actual route of the process, which plans on the basis of the operations performed on the production line. The SKS operations includes cutting (P1), Deburring (P12), Face Drilling (P3), Milling (P4), Turning first half side on CNC (P5), Turning second half side on CNC (P6), Heat Treatment (P7), Grinding (P8), Electroplating (P9), Final-Inspection (P10) and Packing & Dispatch (P11) of the product are drawn in current VSM shown in Figure 1.

3.3 Predicting future VSM

All recommended alterations are applied on the present VSM to foretell the VSM for future (refer Figure 2) by applying suggestions of brainstorming through videography analysis that eliminates wastes in the process flow. The proposed feasible suggestions or Kaizen are taken as Kaizen events to be executed to bridge the gap between current and future VSM.

3.4 Takt Time Calculation

In present case, While calculating, certain notions are made in which the variants in the labor, machine and shift-wise calculations are not taken into account:

- Monthly requirement of the SKS = 14625 nos.
- Monthly Active days = 25 days,
- Day-wise requirement = 585 units,
- Usual hours at work in a shift = 7 hours [Eliminating 2 breaks of 30 minute (each) for lunch and 2 breaks of 15 minutes (each) for tea],
- Useful time at work in a day = 840 minutes.

Takt Time = Useful time at work in a day (minutes) / Day-wise requirement (Items) = 840/585 = 1.43 minutes per item

From Current VSM, the Takt time is computed as 1.43 minutes per unit. The value-added time for SKS is 9.51 minutes whereas production lead time is 17.985 days. Taking calculated Takt time as a benchmark, a chart of cycle time versus process sequence is drawn to identify process requires improvements (Kaizen). From Figure 1, it is found that P8 has cycle time (1.7 minutes) above Takt time. The process P8 has also observed bottleneck process at station “Grinding” due to high rejection rate and thus the process has taken into consideration for process improvement using brainstorming with videography due to higher cycle time, WIP and quality issues.

ISSN: 0971-1260
Vol-22-Issue-17-September-2019

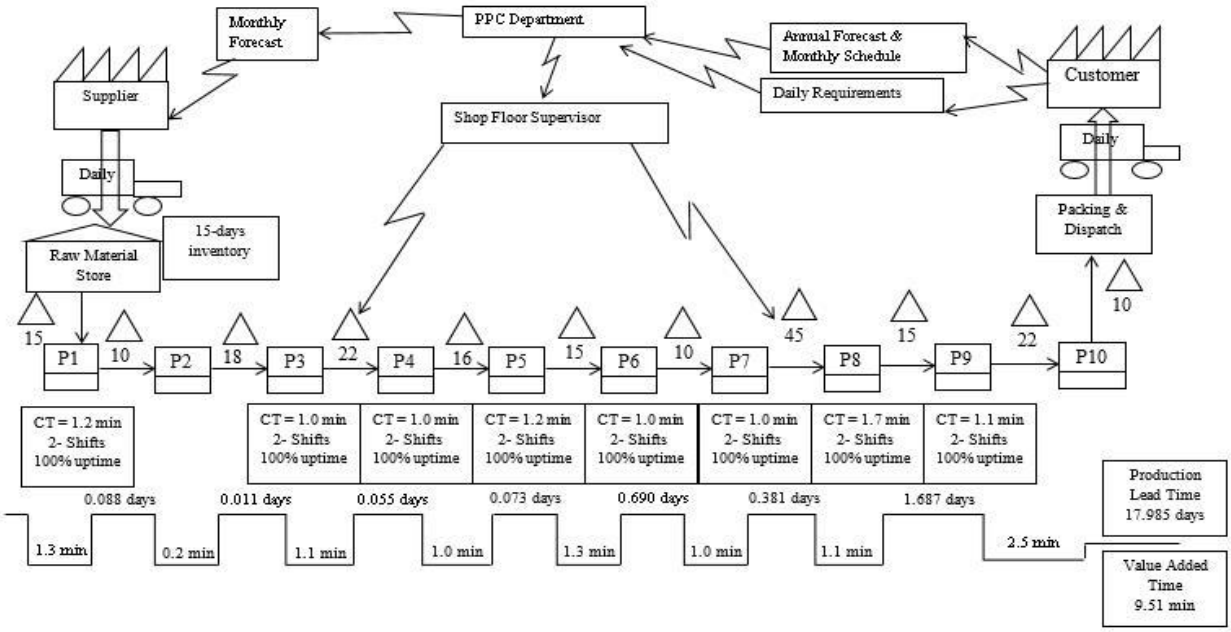


Figure 1. Current VSM

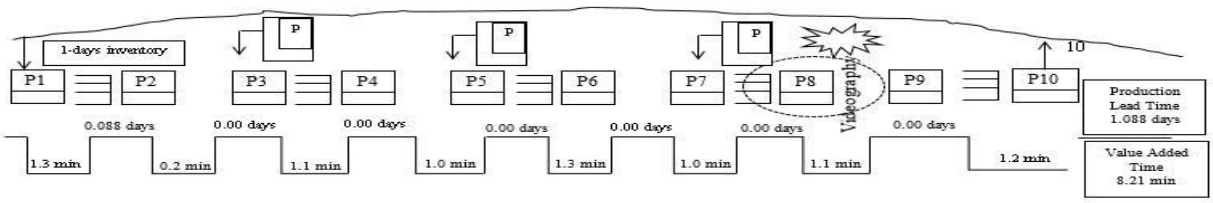


Figure 2. Future VSM

3.5 Brainstorming Process & Proposed Kaizen

One movie (2 hours) of real time operation of identified processes P8 selected for improvements was prepared by using Handy cam (Sony, 64x) which captured concise activities of man, material, method and machine to accomplish the selected processes. The solutions for the identified problems have been suggested by exploring the activities using brainstorming. A conference meeting of 4-6 relevant members was called to examine this movie. The suggestions were requested from the core team involved in, (proposed Kaizen) for quality and production improvement on plain papers. The root cause was identified by the team members through why-why analysis as follows. The suggested points discussed among the core participating team to trigger a feasible suggestion proposed as Kaizen. Everyone in the team is assigned with a particular deadline to finish the said work.

Problem 1: STEPS ON OUTER DIAMETER

- Why 1: Variation in the width of the slot in the component during clamping.
- Why 2: Variation in the width during inspections as compared to drawing.
- Root Cause: Variation in the width of the slot in the component during clamping.

ISSN: 0971-1260
Vol-22-Issue-17-September-2019

- Proposed Kaizen: Clamping on Serration side

3.6 Performing Kaizen Event

Clamping on Serration side to eliminate steps on outer diameter problem. While clamping the work piece for grinding operation wheel dash mark and steps on outer diameter is observed which increase in house rejection of industry. The improvement is made by clamping on serration side of the work piece to eliminate problems of steps on outer diameter which is shown in Figure 3. The place of clamping bush has been moved to serration side to ensure better clamping and minimize the vibrations during the machining of SKS. The bush used for clamping on the serration side is suggested to be replaced after production of every 25000 pieces.

Figure 3. Clamping moved to serration side before and after VSM implementation

4. RESULT ANALYSIS

After implementation of the VSM (Refer figure 4), the comparison of the new data has been made with the previous data to gauge the viability of videography to identify Kaizen events in order to improve production and quality of SKS. After the analysis, the recommended Kaizen events were employed for a working phase of 45 days and following conclusions & gains are given as enhancements in specifically chosen SMEs.

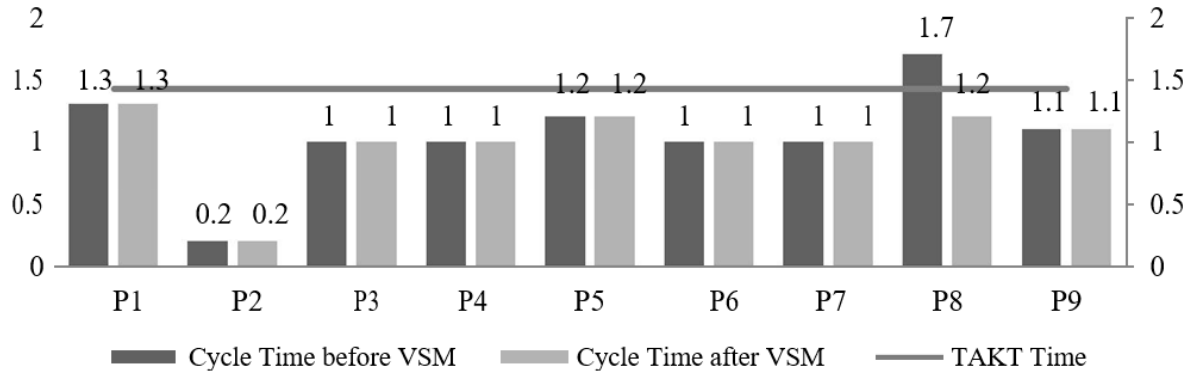
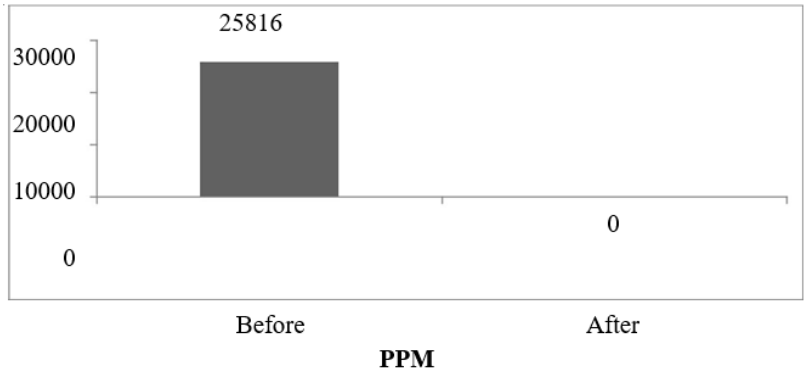


Figure 4. TAKT Time comparison with cycle time of Current & Future VSM

ISSN: 0971-1260
Vol-22-Issue-17-September-2019

Improvements in Production, quality and reduction in rejection rate of SKS products. It has been for a tested for 20 days span considering the two shifts, the rejections due to wheel touch and steps on the outer diameters were not reported.

- The problems like step on the outer diameter and wheel dash on the face got abolished.
- Enhanced customer satisfaction by 12% observed in quality & on time delivery improved by 6%.
- Achieved zero PPM (Parts per Million) level (refer Figure 5).
- No customer complaints and the rejection cost (Rs. 2.35 lac) incurred due to poor quality has been saved.
- Easy to clamp the piece.



- Production lead time diminished by 93.95% (Earlier it was 17.985 days and reduced value is 1.088 days).
- Cycle time reduced by 13.66% (from 9.51 to 8.21 minutes).

Figure 5. PPM before and after VSM.

5. CONCLUSIONS

The result analysis reported significant improvement in production of SKS (Process 8) by 6% and improved on time delivery performance and quality rating of the selected SME. The Lean-Kaizen concept using VSM is best suited for SMEs in which improvement can be identified easily, suggestions (Kaizen) can be implemented quickly and result obtains in terms of improvement in production and quality of products. When it has been implemented in actual working at shop-floor, It gives different opportunities of advancements progressively working each time. This technique is appropriate to a wide range of items, methods and procedures to accomplish advancements in framework, procedure or methodology and helps to reduce the time required for the training of workers in the organization.

REFERENCES

[1] Anand, G, Kodali, R (2009) "Development of a framework for implementation of lean manufacturing systems" *International Journal of Management Practice*, 4(1), 95-116.

[2] Arya, AK, Choudhary, AS (2015) “Assessing the application of Kaizen principles in Indian small-scale industry” International Journal of Lean Six Sigma, 6(4), 369–396.

[3] Barber, C S, Tietje, B C (2008) "A research agenda for value stream mapping the sales process" Journal of Personal Selling & Sales Management, 28(2), 155-165

[4] Bicheno, J (2004) "The new lean toolbox" *Buckingham*: Picsie Books.

ISSN: 0971-1260
Vol-22-Issue-17-September-2019

[5] Bowles, J, Hammond, J (1991) "Beyond quality: How 50 winning companies use continuous improvement" *Putnam Pub Group.*

[6] Buehlmann, U, Fricke, CF (2016) "Benefits of Lean transformation efforts in small- and medium-sized enterprises" Production & Manufacturing Research, 4(1), 114–132.

[7] Donaldson, L (2002) "Damned by our own theories: Contradictions between theories and management education" *Academy of Management Learning & Education*, 1(1), 96-106.

[8] Dora, M, Van Goubergen, D, Kumar, M, Molnar, A, Gellynck, X (2013) "Application of lean practices in small and medium-sized food enterprises" British Food Journal, 116(1), 125-141.

[9] Doria, J, Rozanski, H, Cohen, E (2003) "What business needs from business schools" Strategy and Business, 38-45.

[10] Grunberg, T (2003) "A review of improvement methods in manufacturing operations" *Work study*, 52(2), 89-93.

[11] Hallgren, M, Olhager, J (2009) "Lean and agile manufacturing: external and internal drivers and performance outcomes" *International Journal of Operations & Production Management*, 29(10), 976-999.

[12] Karim, A, Arif-Uz-Zaman, K (2013) "A methodology for effective implementation of lean strategies and its performance evaluation in manufacturing organizations" *Business Process Management Journal*, 19(1), 169-196.

[13] Khan, Z, Bali, R K, Wickramasinghe, N (2007) "Developing a BPI framework and PAM for SMEs" *Industrial Management & Data Systems*, 107(3), 345-360.

[14] Liker, J (2006) "re:"lean adoption", liker@ umich edu, e-mail to Bhasin" S, Sanjay bhasin@ hmps gsi gov uk 27.

[15] Lyons, A C, Vidamour, K, Jain, R, Sutherland, M (2013) "Developing an understanding of lean thinking in process industries" *Production Planning & Control*, 24(6), 475-494.

[16] Prashar, A (2014) "Redesigning an assembly line through Lean-Kaizen: an Indian case" *The TQM Journal*, 26(5), 475-498.

[17] Rother, M and Shook, J (1999) "Learning to see." *Lean Enterprise Institute*.

[18] Seth, D, Gupta, V (2005) "Application of value stream mapping for lean operations and cycle time reduction: an Indian case study" *Production Planning & Control*, 16(1), 44-59.

[19] Singh, B, Garg, S, Sharma, S and Grewal, C (2010) "Lean implementation and its benefits to production industry" *International journal of lean six sigma*, 1(2), 157-168.

[20] Singh, B, Garg, SK & Sharma, SK, 2011 Value stream mapping: Literature review and implications for Indian industry International Journal of Advanced Manufacturing Technology, 53(5–8), pp799–809.

[21] Singh, B, Sharma, SK, (2009) "Value stream mapping as a versatile tool for lean implementation: an Indian case study of a manufacturing firm" *Measuring Business Excellence*, 13(3), 58–68.

[22] Thanki, SJ, Thakkar, JJ (2016) "Value–value load diagram: a graphical tool for lean–green performance assessment" *Production Planning & Control*, 27(15), 1280–1297

[23] Villarreal, B, Garza-reyes, JA, Kumar, V Lim, MK, Villarreal, B, Garza-reyes, JA, Kumar, V Lim, MK (2016) "Improving road transport operations through lean thinking: a case study" International Journal of Logistics Research and Applications, 1–18.

[24] Womack, J and Jones, D (2005) "Lean Solution" *Free Press Pubs,* New York.

[25] Zhou, B (2012) "Lean principles, practices, and impacts: a study on small and medium-sized enterprises (SMEs)" *Annals of Operations Research,* 1-18.