Application of lean manufacturing with KAIZEN tool in a small scale industry- A case study in foundry

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ABSTRACT

Keywords:
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Small Scale Industry (SSI) sector accounts for over 90% of industrial units in the country, 8 percent in the GDP, 45% of manufacturing output and approximately 40 percent of exports as per MSME report 2018. This shows the importance of small-scale industries in the economic development of the country. But due to lack of knowledge and misunderstanding about Lean Manufacturing Process (LMP), SSIs are not implementing or not understood the significance of the same. For every industry the ultimate goal is to enhance productivity through simplified system with less financial implications. Hence, in this paper, an attempt has been made to apply LMP with KAIZEN as a tool to improve productivity by simple and easy means which do not involve any financial investment but change the attitude towards the betterment by waste removal and continual improvement as it is beneficial to SSI.

1. Lean Manufacturing and Small Scale Industries

Lean Manufacturing philosophy (LMP) is adopted by organisations to reduce wastes and improve the quality of products. The aim of lean manufacturing is better quality, low product cost, timely delivery by shortening the production time, eliminating waste etc. There are seven wastes define by LMP namely Motion, Inventory, waiting, defects, Overproduction, Transportation, over processing. [1- 4]

In case of Small Scale Industries (SSI) there is some evidence that smaller firms have adopted and benefited by LMP. Many are not successful in implementation as they did not actually understand what LMP is, or they often did not adopt the major components of Lean management system. There aremany barriers for implementing lean principles in Small Scale Industries (SSI).The major barriers are misunderstanding the concept of LMP by decision makers, owners, financial consultants, trainers, Organisational culture etc. Implementation of lean management techniques is beneficial to the SSI in many aspects. To mention, small inventories, improved quality, shorter lead time, reduced wastes and lower costs are some very important benefits that can be achieved by small scale similar to Large Scale Industries or MNC's. Researchers have stated that Small and medium scale Industries have even more potential than large scale enterprises or MNC's towards implementation of lean principles [5]. This is due to the characteristics that they are more flexible, have greater amount of multifunctional workers and have a management staff closer to operations and production. All of these qualities can contribute to a successful lean system. There are various type of lean tools available, like cellular manufacturing, JIT, KAIZEN, 5S, Production smoothing, standardization of work, total productive maintenance (TPM), SMED, etc. Every tool can be applied depending upon the end requirements.

The aim of this paper is to implement LMP with KAIZEN as a tool in small scale foundry. The case study was a foundry section of at NETCHMECH Foundry Pvt Ltd, a small scale foundry in Kolhapur

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district, Maharashtra, India. The aim was to continuous improvement which resulted in considerable waste reduction and productivity enhancement.

2. KAIZEN Introduction

The word KAIZEN indicates a process of continuous improvement of the standard way of work which involves top management, managers to workers. [6]. It is Japanese philosophy which means continuous improvement. 'Kai' mean "Change" & 'Zen' mean "Good" the whole purpose of which is betterment of work & improving the organization efficiency[7]. The concept of KAIZEN is to make simple, common sense improvements and refinements to critical end-to-end business processes supporting the overall continuous improvement strategy of the organization by waste reduction to enhance productivity.

The KAIZEN philosophy has been implemented in organizations as a way to improve productivity which also improves employee morale and safety. Less awareness is found in SSI as they assume these techniques are designed for Large scale Industries and also requires lot of investments to implement. The KAIZEN philosophy may be applied to any workplace scenario due to its simple nature. The KAIZEN is one of important tool of Lean Manufacturing.

3. Implementation of LMP–KAIZEN as a Tool

In LMP, members of all cross sections or departments in industry are to be involved and all are to be made well aware about its basics, its philosophy, methodology of implementation and its advantages. The following are steps considered before going for implementation.

1. Decide upon a section of the business, upon which lean KAIZEN will be implemented.
2. Allocate the team leader for the group– Training all leaders is important task.
3. Calling entire team and explain them the theory and importance behind KAIZEN, Brainstorming and discussion with team.
4. Team leader can decide the issues going to be tackled. In case they need external help, they can consult with the management .
6. Team is given task to identify the area and finalised the area in consideration with decision makers/ management.
7. Implementation of Lean KAIZEN by defining the time frame.
8. Measure the results and discuss on same for further continual improvement.

4. Survey of Industries in Kolhapur District

Data collection is important task to find out the exact LMP awareness and to have better understanding for LMP implementation. Thus a Survey was carried out for SSI located in Kolhapur district (Maharashtra). The questionary was prepared to explore areas of Lean and its different tools for application. The results of survey shows that many companies in the Kolhapur are committed to implement LMP but had some misconceptions like finance, decision making, education, application, market demand etc. Many have attempted to use the Lean tools at part but less education of LMP and its application was hurdle in successful implementation Based on scientific data after survey it was decided to conduct the case study in small scale foundry. Case study was conducted at NETCHMECH Foundry Pvt. ltd, Kolhapur. Major focus was to enhance productivity by eliminating wastes and continuous improvement with no or little investments. Thus, KAIZEN as a tool was decides as a tool for implementation of LMP.

Industries selected for survey were of four types i.e. Machine shop, Foundry, Press/forging shops.

Type of Industry	Total	Percentage
Machine shop	30	60
Foundry	15	30
Press shop /Forging	05	10
Total	**50**	**100**

From the Survey, industrialist from SSI is of the opinion that investing in people and technology for productivity enhancement is not suitable as it involves a major risk. 80% Industrialist think that they find risk in investments and the major reasons are

- Trying to be in comfort zone
- Product variety and volume
- Uncertainty of payments from market
- Market uncertainty
- Peer competition

- Resistance to change
- Government rules and regulations

5. A Case Study: Application of LMP- KAIZEN as a Tool

5.1. Section: foundry-moulding

Problem identification :

To observe the existing moulding process and remove the flaws to enhance the moulding productivity. It was practiced in foundry that Sieve and Rammer were taken on ground floor so it was very uneasy and cumbersome, more laborious to operator while carrying out the mould preparation.

Objective:

To minimize the labour efforts and increase mould productivity.

Action taken:

Instead of taking sieve and Ram on the ground floor, it was decided to prepare a stand suitable to worker height for rammer and sieve making comfortable to the operator to prepare a mould.

Improvement due to KAIZEN activity:

- Labour efforts minimized due to development in the setup.

Fig. 1. Previous Hammer and sieve position.

Fig. 2. Moulding section installed with stand.

- Easy to handle
- Reduced fatigue and safer work environment.
- Saved 30 seconds per box thus production increased by 8 boxes per shift thus enhancing
- productivity by 3%.

Case Study–II

5.2. Section: Sand plant

Problem Indentified:

It was noticed that compressor use to remain ON even though there was no need of the compressed air for any production activity carried out.

Problem analysis:

During study, it was observed that there was leakage in air carrying pipe and was ignored by the shop floor people.

Remedy taken:

The pipe was changed and Compressor setting was done at 6.7 bar so starting and stopping of compressor was made automatic. Thus, the use of compressor was maximised, losses were avoided.

Benefits:

1. Saving in Electrical energy i.e. 30 units per day was observed

2. Saving of Rs. 65000/- per year thus contributing to productivity.

Case Study-III

5.3. Section: Fettling shop

Objective: To improve fettling productivity

Problem: Casting defect inVeining was located in Crank case which appears on the surface of fins or veins due to thermal expansion of silica sand. These defects were detected at the customer end and creating problem during assembly. Therefore it was necessary to check and remove veins which was appearing in fixed area on inner side of casting

Problem analysis:

Veins removal was done manually with hammer and chisel and these use to take lot of time and fatigue as those appeared on inner side of casting. Skill was required to remove the veins as care has to be taken so that chisel doesn't harms the casting. Single worker use to do 100 jobs per day and 6 workers were assigned the activity.

Remedy taken:

Developed a simple tool perfectly suitable for

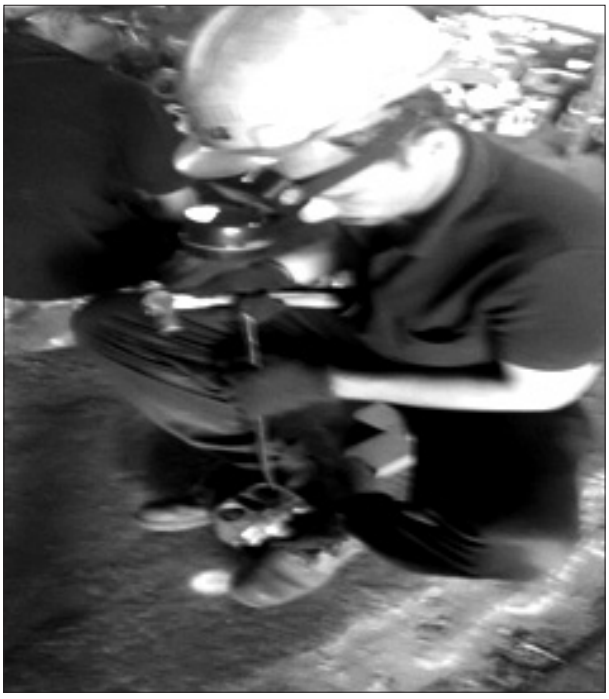

Fig. 3. Previous fettling.

Fig. 4. Fettling with developed tool.

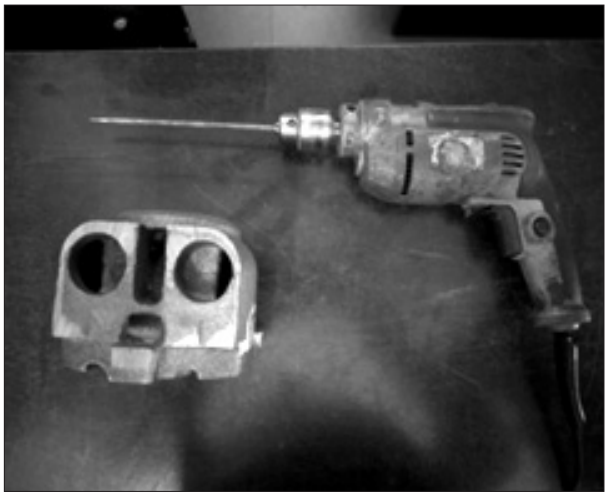

Fig. 5. KCG crank case and fettling tool.

Fig. 6. Fettling of KCG crank case.

fettling of KCJ crank case. Hand drill was attached with simple steel rod which was flattened at its end as shown in figure 5. These made the fettling work very easy and fatigue free.

Results:

1. Man power reduced from 6 to 1 and thus reduced manpower cost.
2. Reduced fatigue
3. Increased tonnage in dispatch.
4. Fettling Per day per person increased from 100 to 600 jobs per day and yearly saving of Rs. 4.68 Lakhs in terms of labour cost was achieved.

Case –IV

5.4. Section: Core shop

Objective: Core weight reduction

Problem: Excess sand used for core.

Problem analysis:

It was decided to work on cost reduction of core. The process parameters like strength, permeability, refractoriness and surface finish were well defined and fixed. Concentration was on minimizing the core sand required for NGCR core which ultimately reduces cost and thus enhancing productivity.

Action taken:

Study of existing core and core box was done and decided to reduce the sand from central portion. Thickens of core was kept 8 mm and was checked so that those doesn't break after metal pouring. Making core hollow is common technique for core weight reduction but it is not so simplebecause thickness has to be properly maintained as it depends upon the temperature and time of metal required for cooling. The core and core box assembly was checked on Creo-3.0 parametric. Weight calculation was also done primary on software and then it was practically applied.(Ref. Fig. 7 and Fig. 8).

Improvement due to Kaizen activity:

1. Core Weight reduced by 0.130gm per core.
2. Before Action core weight : 0.890gm
3. After Action : 0.760gm
4. Core gas smoothly passed and helped in improving quality of casting.
5. Monthly cores were required 10000 in numbers, thus Rs 2.37 lakhs saved due to redesigning sand core.

6. Conclusion

- KAIZEN is a continuous improvement journey and its applications resulted noticeable improvements in Industry. Thus, implementation of KAIZEN in NETCHMECH Foundry Pvt Ltd, resulted in benefits, may be small in terms of money, electrical energy or manual labor.
- KAIZEN was implemented, where no cost was required in terms of capital machinery. Only cost involved was training and outlook towards the Industry setup.

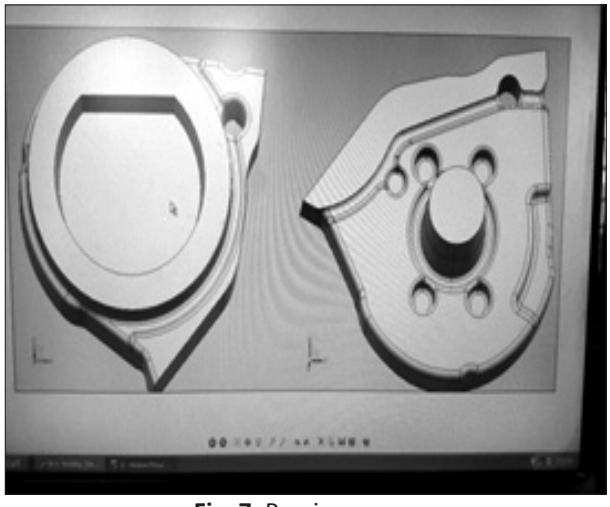

Fig. 7. Previous core.

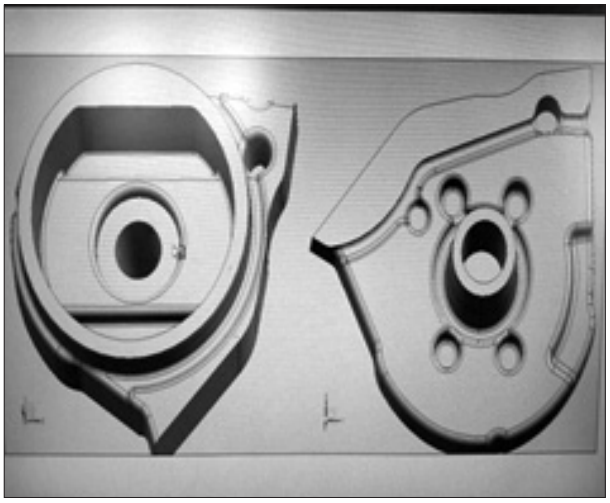

Fig. 8. Present core.

- It doesn't involve highly educated technocrats, KAIZEN was implemented with basic common sense approach which can be adopted and implemented by technicians and workers.
- Additional benefits of reducing manual efforts, increased tonnage in fettling, reduced fatigue of operator and thus enhancing the productivity was achieved.

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