

# Study and Implementation of Lean Manufacturing in investment Casting industry

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**Abstract** -It is undeniable fact that, the Technology has nullified several problems of the world and provides immense benefits. The latest advance in Engineering Science and technology have given engineers powerful tools for re-assessing and recognizing the systems. As compared to the past, the business scenario has been totally changed, competitiveness of manufacturing companies is defined by their capability to meet and respond as quickly as possible by exchanging environment scenario, and to manufacture and supply quality products at economic price according to the customer priority. It can be only possible with advanced industrial Engineering. It is generally agreed that for a Lean Manufacturing program to be effective. It should include a set of tools and techniques or provisions to ensure management commitment, employee involvement, identification of wastes, development of controls for wastes and training and education for employee. These tools and techniques are typical of any comprehensive Lean Manufacturing implementation reduced the wastes in the industry and enhance the profit and production. In order to get its benefits practically, we had initiated to apply those practices in the Northern Alloys Bhavnagar Limited.

**Key Words:** Lean manufacturing, kaizen, sand casting, six sigma, investment casting, TIMWOOD (7 wastages).

## 1. INTRODUCTION

The term Lean Manufacturing stand for application of lean principles, practices and tools to the development of products with better quality. In synonymous we can say simply eliminating waste for Lean Manufacturing. Manufacturer are used lean manufacturing principal to eliminate the waste, improve productivity with quality, on time delivery, reduce cost and time etc. There are many lean manufacturing tools available to help for product improvement like 5s, Poka-yoke, Kanban, kaizen, Push-Pull system, JIT- just in time, Work flow diagram, value stream mapping, Cause and effect diagram, spider chart etc. Those are some tools which highlights the lean manufacturing importance.

All the manufacturing companies are working too hard to achieve their goals, objectives and their abilities by proper manufacturing process and skillfulness by applying automation concepts. There are some innovative concepts which are being used in well-known manufacturing sector such as Lean Manufacturing, Just-in-time (JIT), and total quality

management (TQM), etc. Among them, Lean Manufacturing is considered as one of the best production methods in order to fulfil organization goals. Many large medium size manufacturing companies have adopted this concept and experienced reduction in manufacturing lead time and material handling cost, and improvement in quality with other benefits.

Lean manufacturing is a very important tool used Across the industries in the recent scenario. At present the industries are facing the next level of competition Because of the Globalizing production. In this context, to Remain and compete market, corporations need to Deploy certain tools and techniques that are helpful to the uplift their performance and to reply quickly to the customer 's desires. Concept thought of Lean manufacturing is Manufacturer a top-quality product While additionally compete that the merchandise doesn't value too Much to the client. In this paper a representer has Presented a review of the literature to spot the Important and helpful contributions to the present Lean Concept. Lean producing utilizes a good range of Tools and techniques; the selection of tools is based on the demand. Several parameters contribute success of lean. Organizations that enforced lean Manufacturing have higher level of flexibility and Competitiveness. However, lean manufacturing Provides an environment that's extremely tributary to Waste decrease.

## 2. METHODOLOGY

The aim of this paper is, to observe and examine the error and hardships which are occurring in the industry and then implement the lean manufacturing as much as possible that can fix that obstacles.

### Objective:

1. To study the philosophical view of core subject of the industrial Engineering
2. To observe about future aspects of the northern alloy Bhavnagar limited
3. To get to understand about problems associate with labor and to know about the behavior and company's attitude towards workers.
4. To get conversant with the liaising of Management with Bottom manage.

During this project first of all we were studied various published review papers in area of lean manufacturing. After that, we observed the company's problems and differentiated

problems in seven wastages. And finally, provided a better affordable solution to improve product's productivity with quality.

### 3. Observation of various Wastages

As per lean manufacturing theory, there are 7 most common wastages which are being observed in manufacturing industries namely,

1. Transportation
2. Inventory
3. Motion
4. Waiting
5. Overproduction
6. Overprocessing
7. Defect

During our observation we found some wastages in company which are:

#### Waiting

In this company, there was a bigger problem associated with starting of a work. According to schedule, there had been 3 shifts arranged by upper management, and that was about 7:00 am to 3:00 pm, 3:00 pm to 11:00 pm and 11:00 pm to 7:00 am, about 100 workers used to work in these Shifts. However, the production rate was very lower as per expectation because of some management problems and bad habits of labors. If we talk about workers, they used to reach at company on time but they were starting their work after half hour and sometimes work had been allocated late by upper management. Thus, proper allocation and motivation were supposed to be required. Second major problem that was about time wastage in mould lock. During mould and pattern preparation, it is necessary to use some mould locks, meanwhile, labor had to go to storage to find those locks. As per calculation this process was taking 3 minutes per mould.

#### Inventory

In order to make investment casting accurately, proper sand will be needed. A company uses tones of zircon sand on the yearly basis and management did not aware about wastage of sand. There were two types of inventory wastages had been observed in Northern alloy. Firstly, industry did not have proper information regarding how to re-use this sand within a short time period because it is less effective after few days. Another one, which was leakage of silica in silica tank and maintenance department was taking this problem very lightly.



Photo shows wastage of sand

#### Motion

Apart from other major wastages, smaller one should not be neglected because it can make big impact on big scale. During trolley usage, there was some time wastage happened because of improper path. Moreover, some mould were found on trolley path which was creating some time consuming activity. Therefore, proper path and arrangement of mould should have been needed.



Motion of trolley



Unnecessary work doing by worker create unnecessary motion

### 3. RESULT

#### Solution-1

According to daily analysis, 100 workers were taking minimum 30 minutes per day to initiate their work, its happened due to less communication between top management and worker. The time wasting per day calculate below:

$$\begin{aligned}\text{Wasting time} &= \text{time waste by worker per day} * \text{total worker} \\ &= 30 \text{ minutes} * 100 \\ &= 3000 \text{ minutes (50 hours) per day}\end{aligned}$$

Total working day of month for worker are 30. So total wasting time per month is 1500 hours which is highly affect the production rate.

As per above calculation the total amount of time was wasted by 100 workers, was (hours)/yr. Also, it could also be said that this time could hire new workers which can increase the production. Therefore, we applied Kaizen manufacturing philosophy which can help a lot for continuous improvement. First of all, we motivated labors to start their work within 15 minutes, while upper management got agree and started to come at industry before 15 minutes. If we calculate this time, it saves 50% of time from wasting time, it means we can save 750 hours per months from wasting hours. So, its huge impact on efficiency of production.

#### Solution-2

Whenever labor needed mould locks for mould preparation. They were usually taking 4 or more minutes, meanwhile sometimes they were distracted with their work and wasting their time with other workers. Therefore, we made proper solution to put small boxes which can contain mould locks nearest to worker. Also, it was light weight and utilized less space. Because of that, it saved a lot of waiting time that can be seen in this calculation.

If company made 80 pieces different of investment casting per month and per piece there is 4-5 minutes waiting time define due to above reason, then total waiting time is:

$$\begin{aligned}\text{Total waiting time} &= \text{total piece} * \text{waiting time per piece} \\ &= 80 * 4 \text{ minute (taken minimum time)} \\ &= 320 \text{ minutes (5.3 hours) per month}\end{aligned}$$

So, total waiting time per year is 63 hours which affect the production rate at long term period. If we are making small boxes near the casting area, we can save this waiting time.

#### Solution-3

Trollies are used to transfer different type materials in foundry industry. As we observed in Northern alloy, there were no proper path designed for trolley which was creating unnecessary movement in company and that was affect the production flow. Company made a yellow line path which was economic way to reach destination. Moreover, company

made strict rule where no one can put any accessories on the path.

#### Solution-4

Investment casting can be precisely done by zircon sand, but if it is re-used within a short period (when the quality of sand is better to use), it can save large sum of money. Thus, we observed the main inventory wastages. Initially, company focused on how to carry zircon sand in a better place after completion of casting process where they can again use it. Indian market price of zircon sand is approx. 100 rupees per kilogram. So, reused of sand is very important factor to increase company's profit.

### 4. CONCLUSIONS

After elaborating every point, it can be recapitulated that this paper can solve ample of problems which are being found in foundry industry, as well as companies can get to know about lean manufacturing implementation. Firstly, it is necessary to find background information (whether they are involved in lean manufacturing or not). If not, then they have to understand about advanced manufacturing system, also they must know about lean manufacturing philosophy which have been used by various multinational companies. As consequence, unaware firm will know about its benefits regarding productivity improvement and reduction of 7 different wastages (TIMWOOD). Apart from that, HR management is supposed to hire a separate staff who can analyze and find problems and faults which occur owing to some resistance and then they ought to make some calculation with statistic analysis. So, management can understand the overall impact of specific problem. Eventually, by implementing lean manufacturing, company can increase its productivity and eliminate such problems.

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