

# Implementation of Product Lifecycle Management in Metal Casting Industry in the Area of Manufacturing Process Management-A Case Study

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**Abstract:** The metal casting industry, small to medium sized industries, has the obscurity of executing enhancements in its interior logistics scheme, and, it has to pact with the troubles occurring in the company. The product lifecycle management is seen as main infiltrate route and is extensively used by foremost industries all over the globe. The Product Lifecycle Management is distinguished as a part of manufacturing system that is concentrating in continuous flow within supply chain by removing all wastes and effecting unremitting improvement across product superiority. This paper deals with the manufacturing process management so as to implement in small scale foundry by exploring the troubles existing in these processes and realizing a variety of product lifecycle management tools and analyzing the results of a case study.

**Keywords** —*Implementing, Manufacturing process Management, Metal casting industry, Problems existing, Small scale, Case study*

## I. INTRODUCTION

The manufacturing industry is facing hard-hitting assessments. Many factors are forcing a transform in the mode where products are designed and manufactured, and furthermore in the way they and their connected business operations are managed. Product life cycle management (PLM) has been considered for more than two decades as the ideal method to most effectively and efficiently manage a product throughout its life cycle. Despite the growing necessity for such management in all business, the life cycle management concept has been implemented in very few situations. This is due to the lack of a systematic approach, and limited access to the relevant life cycle management tools and techniques. The expense of implementing such a management concept by an existing business is also a barrier. It is therefore for this research to look at the ways to improve the speed and effectiveness with which life cycle management can be developed and applied to a product life cycle process. According to manufacturing aim PLM is an incorporated socio-technical method where the foremost intention is to eradicate dissipates by simultaneously tumbling or minimizing supplier, customer and interior inconsistencies and management all through product life cycle. Explicitly PLM is a thinking of manufacturing that highlights on the minimization of the quantity of all the possessions used in the various performances of the enterprise with the observance in mind the needs where the product has to be convene. It engrosses identifying and

eradicating non-value-adding performances in devise, manufacturing, supply chain management and trading with customers. PLM utilizes teams of multi skilled labours at all stages of the business and use highly supple, increasingly automated machines to produce volumes of products in potentially enormous variety. It contains a set of principles and preparations to lessen cost through the unremitting removal of squanders and through the generalizations of all manufacturing and support processes. The implication of a PLM model contains: manufacture of only one unit at a time; non-value added time eliminated; production of the job within time pre decided; relocation of required resources to the point of usage; and all processes must be finished within the time as planned. PLM technique has a great importance with Indian small scale Industries. In India Small and medium Scale metal casting companies plays a very crucial role in Indian financial system. Manufacturing Process Management (MPM) is the process of managing and directing the manufacturing processes used to make castings in case of foundries, assemble final castings, and carrying out inspection of castings. In any PLM system, the MPM process is the essential link from product design to manufacturing implementation. In this work case study is carried in a small scale foundry called GWASF Quality Castings Private Limited Company, Mangaluru where PLM is implemented in the area of MPM to find out the problems occurring and to resolve the same by analysing using various tools of PLM.

## II. LITERATURE SURVEY

There has been very limited academic literature published in the area of foundry MPM, and almost non-existing in MPM related to data collection supporting manufacturing control plan, and hence the novelty of this paper. Vedel-Smith et al. presented a methodology for enabling MPM of cast iron foundries by part number marking on individual castings [1]. Arabatzis et al. described the issue of MPM in aluminium foundry [2]. McFarlane et al, Manufacturing Process Management (MPM) proved that in metal casting industry the production rate has been increased significantly without any losses and without compromising the quality of castings which are utilized in automobile industries. . Foremost attempts has been done in recent past with the exploitation of commercial relevance's where it is capable of incorporating the intricate and configurable BOM (Bill of Material) with that of an equally convoluted BOP (Bill of Process), within an milieu that support the assessment of substitutes and the growth, storage, and comparison of for the time being infeasible scenarios, in search of optimal designs in foundries [3]. Kim, H.M. et.al, the furthestmost gain from MPM can be seen in enhanced manufacturing efficiencies resulting from more firmly premeditated and managed manufacturing schemes. It is very rare in small and medium scale foundries to see efficiencies increase by eight percent in mixed-model environments. Innovative or customized metal casting both ferrous and non ferrous products commence times have been condensed by 35 to 45% first and foremost due to the ease of use of immediate in sequence, and to the benefits of bowdlerization existing similar processes, rather than using compromising techniques from graze which is often done in the many metal casting industries [4]. According to Chow, H.et.al., MPM use gives the manufacturing division to analyse and use the data in most efficient way which intern leads to increase in production rates which results reduce in cost of the product , manufacturing lead time final casting inventory, and to improve overall product quality and production responsiveness. The advantages can be witnessed in the area of utilizing the information of the metal casting component in each stage of manufacturing it may be pouring, fettling, machining and finished process like sand blasting or shot blasting . According to Vokura, R.J., et.al, [5] by applying the manufacturing management process in large scale metal casting industry it was able to disseminate the product knowledge for each of the department that may be marketing, purchasing, melting, fettling, cleaning, machining, subcontracting finance accounts and other departments. The information obtained was accessible for all the above aid departments which resulted in increasing the efficiency of the company to certain extent.

## III. METHODOLOGY

MPM systems can be utilized to such an extent where the bill of materials from casting department and machining department and the other department which is available in electronic form can be easily accessed at any required time. This will help the finance department to rise the fund to purchase the raw material for casting purpose the raw material may be ferrous or non ferrous the finance department in turn plan to reduce the burden of loan also. These MPM systems can also make the production Engineer to plan efficiently the melting pouring fettling cleaning and machining schedule without compromising the quality to meet the dispatch of the metal cast product to the necessary customer within required date. By implementing MPM in metal casting industries the production sequence followed in the pattern making melting, pouring fettling cleaning sand blasting shot blasting and machining can be documented at each stage so that at each step the information available in the electronic form. This information is very much essential to improve productivity to diminish chaos between different departments. The reduce cost of each product the MPM implementation is of utmost important and inevitable part in present small and medium scale metal casting units before the launch of product to market. The reason of this swot is the implementing of an assortment of PLM tools in small to medium sized foundry industry. The main steps of work:

- Learning of manufacturing processes involved in a small scale foundry.
- Detection of problems arising in the metal casting firm.
- Analyzing an assortment of source of problems.
- Implementing the diverse PLM tools of MPM
- Preparing surveillance table of manufacturing rate
- Analysis of the result procured

### A. Production process flow chart

The below flow chart depicts the manufacturing process carried out in the small scale foundry .figure 1 Depict the flow of process chart of foundry industry.

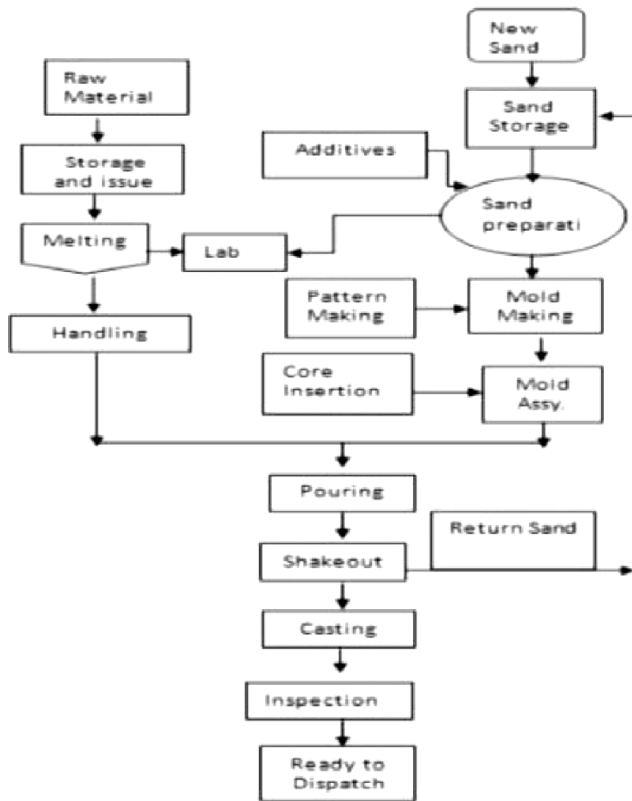


Fig.1 Flow Chart of Production Process

B. Predicament recognized in the metal casting industry

Manufacturing tempo is lesser as per business specified objective of the day, they accomplish merely 70% production in a day and residual was 30% production is completed in next day. For exemplar if they make manufacturing plan of 17 metric ton per day but they are able to achieved only 15 or 15.5 metric ton per day often further only 11 or 11.5 metric ton production is obtained or casting are transfer to the big success. The main causes for the problem were raw material shortage. Man power struggles, breakdowns and assembly line problems.

IV. PLM TOOLS IMPLEMENTED IN METAL CASTING INDUSTRY

The most common lean tools that can be utilized for MPM, such as

- Kaizen (Japanese for “improvement” or “change for the improved”) –A scheme where employees work mutually proactively to accomplish regular, incremental enhancement in the manufacturing processes.
- Kanban (Japanese for “signboard” or “billboard”, which is a scheduling system for just-in-time JIT production)- A method of regulating the flow of goods both within the factory and outside suppliers and customers. Based on automatic replenishment through signal cards that indicate when more goods are needed.

- 5S (the name of a administrative centre business method based on five Japanese words that is seiri, seiton, seiso, seiketsu, and shitsuke, translated into English as sort, set in order, shine, standardize and sustain. Benchmarking eradicate squander by time after time pertaining best practice. Forms a baseline or future development activities.
- TPM (Total Productive Maintenance) - generate a shared accountability for equipment that encourages superior participation by metal casting firm’s floor workers. In the right milieu this can be very helpful in getting better productivity (increasing up time, reducing cycle times and eradicating defects)
- SMED (Single Minute Exchange of Die)- Enables industrialized in slighter lots, diminish account, and improves client responsiveness.
- Six big losses- Six class of productivity loss that are almost collectively qualified in manufacturing: Breakdowns, setup/adjustments, small stops, reduced speed, start up rejects and production rejects. Figure 2 depict different.PLM tool which can be implemented in the area of Manufacturing Process Management.

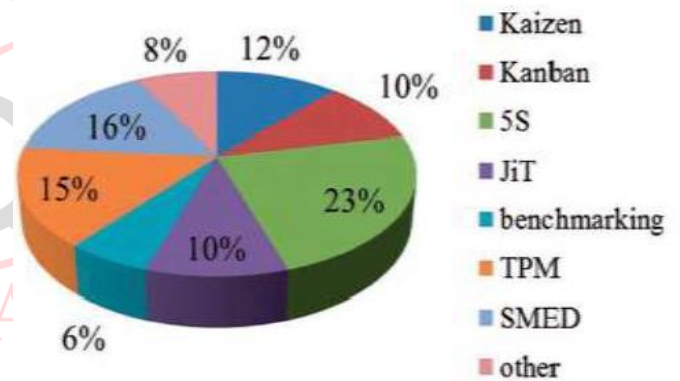


Fig 2: Tools of PLM

It is visible that the 5S system is the most popular [6,7,8]. It is also the simplest and often a no-cost approach. 5s stands for-

- Set in order (organize remaining items)
- Shine (hygienic and inspects work area)
- Sort (eradicate that which is not needed)
- Standardize (write standards for over)
- Sustain (habitually apply the standards)

That is it eliminates squander that results from a poorly planned work area. (e.g. wasting time looking for a tool) examination and observations

In the metal casting industry work is carried out in three shifts/day (man power shift) from 7.00 am -3.00 pm, 3.00 pm-11.00 pm and 11.00 pm-7.00 am with two breaks of half

an hour. There are 26 working days per month. The five months investigation of metal casting industry about the demand rate, planned rate and manufacturing rate are established out and as shown below table 1

Sr No.	Demand rate (tons/month)	Planned rate (tons/month)	Production rate (tons/month)	Total scrap (In %)	Ok production rate (tons/month)	Production efficiency (In %)	Delivery efficiency (In %)
1	560	610	507	2	496.86	81.45	88.72
2	510	560	468	2	458.64	81.9	89.92
3	500	555	442	2	433.16	78.04	86.63
4	560	620	481	2	471.38	76.03	84.17
5	600	670	520	2	509.6	76.05	84.93

Table 1: Five month Production analysis of foundry

### V. RESULTS AND DISCUSSIONS

Figure 3 depicts the Graph of production rates in tons/month. It is clear from the graph that production rate which is all right after the implementation of PLM in the area of Manufacturing Process management. There is only 2% wastage which is reduced satisfactorily after implementation. Figure 4 depicts the graph of production and delivery efficiency. From this it is very clear that production and delivery efficiency increased after implementation of PLM.

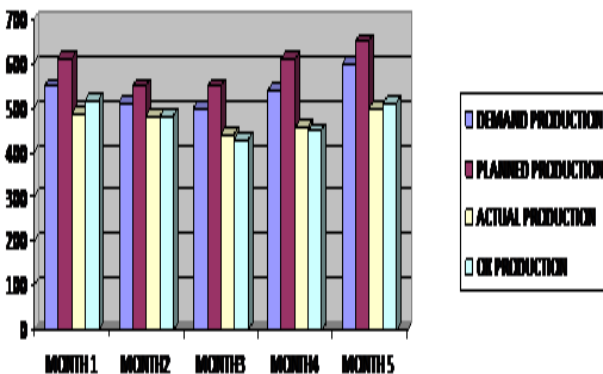


Fig 3: Production rates in tons/month

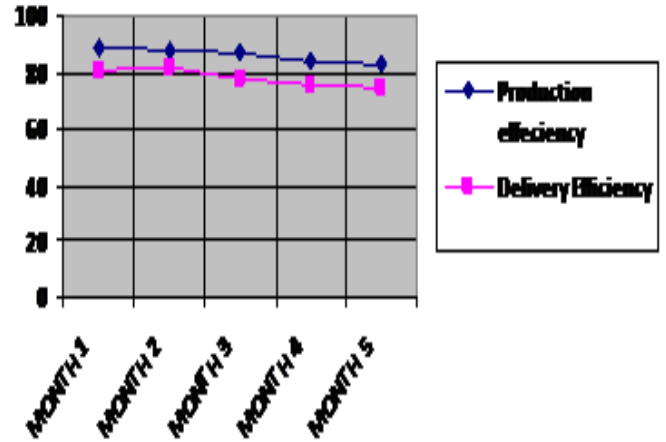


Fig 4: Graph Of Competence

### VI. CONCLUSION

In India SME's plays a very imperative role in Indian financial system, the expected result of the analysis is to spotlight on the manufacturing rate at small to medium scale metal casting industry. After analyzing the five months data of the metal casting industry, in the second month when the insisted rate is 510tons/month, planned rate is 560tons/month and production rate is 458 tons/month then furthermost manufacturing and delivery competence is attained for the reason that there is a fewer scarcity of raw material in inventory management division, Proper safety measures are taken to trim down number of breakdown and Proper sequencing of workstations by implementing PLM Manufacturing Process Management to condense assembly line inconveniences to convinced echelon.

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