

Lean Manufacturing Practices in Foundry

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There are significant global growth opportunities for automotive & industrial castings. The global economic situation is driving demand for cost competitive suppliers across all industries. This is a welcome opportunity for Indian foundries. The weak rupee and export incentives are added factors that can support our drive for higher volumes in the global market,

The global economic scenario is largely influenced by several varied external factors at different times, which in turn creates volatile raw material costs over which foundry manufacturers have very little or no control. However the foundry industry must focus more on internal factors like technological up-gradation and operational excellence on which they have full control.

Lean manufacturing practices are amongst the most popular tools available to all companies, to help attain operational excellence. A good lean philosophy to practice is "Compete against perfection not competitors, by identifying all activities that are muda and eliminate them.



Methodology

Lean manufacturing practices are arguably the best available tools to achieve excellence in any operations. Sigma foundry manufacturing philosophy is built around the belief that to succeed and achieve profitable growth, we must focus on 7Ps, i.e. People, Plant (Machinery), Policies, Product (Quality), Procedures (Customer Service, On Time Delivery), Processes (VSM, 5S, Lean, SWP) and Total Productive Maintenance.

This philosophy is based on implementing lean manufacturing practices like kaizen events, lean tools and Senior Management Leadership program. The major lean tools implemented are-- Value Stream Mapping (VSM), 5S and Visual Management & Control, Standard Work Practices (SWP), Total Productive Maintenance (TPM) and Kaizen culture.

Value Stream Mapping

A powerful two-dimensional tool is value stream mapping. At Sigma we have conducted several Value Stream Mapping events, in order to achieve our Lean goals for each foundry plant.

To improve the value stream flow at our aluminum foundry, we broke down the wall between the die-casting and machining facilities. This helped identify continued opportunities to enhance value, eliminated waste and improved flow. This was an important learning lesson, as we strived to improve our process flow.

VSM has been implemented at our new sand casting foundry plant, helping to create the culture of an integrated plant which can seamlessly handle operations/processes from casting, machining and electroplating, assembly and packaging.



Benefits VSM

Lead Time from Casting to Packaging was reduced from 8 hours to less than one hour. This has helped improve the quality and delivery levels. All issues relating to interdepartmental compartmentalization get promptly resolved and there is focus on the integrated plant.

5 S, Visual Management

A foundry plant is generally considered as a dirty place considering the processes etc. We want to change this myth. We created a vision to inculcate the 5S culture across all Sigma facilities, with an objective to achieve 5S score >4 by March 2016.

5S is actually the foundation for any improvement. Indian foundries must accord due importance to this point. There is a need to break the

mindset right from the Top Leadership, only then will we see very clean and neat foundries. When foundries achieve a high 5S score and are very lean, then this will help the industry to attract talent, which has been an ongoing matter of concern.

Our Lean purpose for 5S implementation was to build a foundation for a successful continuous improvement environment, Lean Enterprise, Create a better working environment and consistent high quality processes, Create a disciplined system to sustain these improved conditions in the future and to improve our financial performance and customer service and unlock organizational value in the present VUCA (Volatile, Uncertain, Complex, and Ambiguous) environment.

Glimpses of 5 S Foundries



Benefits Achieved from 5S

- 5S in foundries helped us to enhance the safe work practices (Number of near misses has gone down significantly)
- We have implemented 'A Visual Factory, so that any abnormalities during the work process are easily identified
- 5S has helped us in promoting our Standard Operating Procedures, a very important element of our Lean toolkit
- 5S also helped us to improve Quality—reduced defect rates sharply

Our international customers continuously compliment us for maintaining our foundries very clean, especially the sand cast foundries, which is not common.

Total Productive Maintenance (TPM)

TPM implementation across all our foundries has brought significant improvements in productivity, quality, cost reductions, set-up improvements, and machine life (Up time), on time deliveries and safe working environment. This has enhanced the morale of our employees.

Keeping in mind the theme, 'Health is Wealth', Sigma initiated a mammoth task of Deep Cleaning on all machines, over 1000 machine tools and equipment. All the plants / functions have a dedicated time for cleaning machines. Today, 100% of our machines are covered under deep cleaning. Under the umbrella of TPM, we have a target to cover 50% of our Machines which will go through the 3D model by March 2016. 3D Model is identification of Dirt, Danger and Difficult and overcoming the same by having a structured action plan in place. TPM in our company revolves around 2 pillars of traditional TPM i.e. Jishu-Hozen and Plant Maintenance. Our "Up-Time" metrics of machines are already at world class levels, hence, now there is added focus on "Sustenance".

Benefits TPM

Our machine availability has improved from 98.5% to 99%. Machine aesthetics has improved. Our machines have substantial reduced breakdowns, reduced maintenance repair expenses and are better

positioned to meet all production requirements. Equipment safety has been enhanced through continuous Fugai (Abnormalities) findings and taking corrective actions to improve the conditions

Other Lean Principles

Sigma practices a variety of Lean Manufacturing principles. In order to be a highly productive and cost competitive producer, we practice Just in time which means: Meet what the customer needs, in the quantity that the customer wants, and when the customer wants it. All the while using minimum raw material, equipment, space and labor.

To operate in JIT, one must follow three principles—TOP

1. T – Pace to Takt Time : All our foundry machines work with a concept of Takt time, where production is matched with the customer's demand. A line balancing concept is introduced in order to make the processes Lean and productive. In case of fluctuations in demand, the cycle times and work forces on the cells are planned very efficiently.

Benefits : On Time Delivery improvement - Service levels improved from 80% to over 96%; achieved +99% in retail sector.



2. O - One Piece Flow : In order to reduce the lead time, the batch size of material flow is reduced. For example, the batch size is reduced from 1000 to 100 pieces, by using lower capacity bins. We eliminated material handling by breaking the wall between die-casting and Machining cells and using gravity conveyors. This reduced transportation of material and excess motion by 100%. We have horizontal deployment plans across all our foundries during 2016.



3. P – Pull System : We operate with a weekly pull customer model. Weekly plan is converted into a daily plan by assembly lines and pull is created. Benefits from Pull System are --Material is pulled through the

system only when needed, and this forces co-operation within the cross functions, departments and prevents over and under production.

Benefits : Inventory Reduction from 150 days to 117 days. Aim is less than 100 days

Kanban

In order to cater to the requirements for a Pull system, a supermarket is established to create seamless pull from packaging cell to Die-Casting, resulting in significant reduction in waiting time on packaging cells. Direct on Line is implemented for a majority of our bought outs. Our vendors replenish bought -outs based on consumption; purchase and operations are no longer involved in placing orders & follow-up. This has helped us reduce stock-outs from 50 to less than 5 in 3 years.



Standard Operations

The best combination of people & machines by utilizing the minimum labor, Space, inventory & equipments is achieved by implementing Standard Operations. All operations in Sigma operate with Standard Operations. This has helped us to identify & eliminate variation in work / processes. It has acted as a benchmark to sustain the improvements achieved from past kaizen events and provided a baseline for future Kaizen activities.



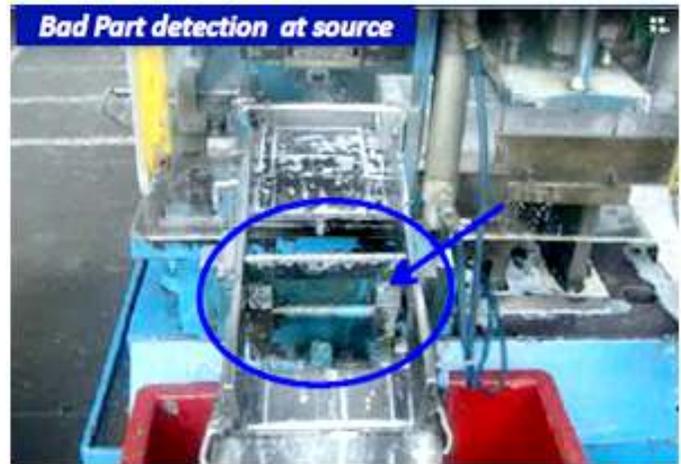
Jidoka

Jidoka is automation with a human touch, as Toyota would say. All manufacturing cells and offices at Sigma have implemented Jidoka. This helps us identifying an abnormal condition within the process & triggers an immediate response for the same. Our Goal is to prevent a defective product from being passed to the next operation.

Benefits : Rejection Improvement – Improved quality by up to 20%

Equipment Automation

Implementation of various Automation initiatives has helped



reduced fatigue and errors. All our cells are designed with a concept of Automation i.e. separate man, separate machine. This has reduced fatigue and has minimized errors due to repetitive work. Our Goal is Multi-process handling, increased labor productivity. This is achieved by Cellular layouts.



Other Strategic Initiatives

Backward Integration, i.e. In-house alloying: High metal prices, resulting in high material cost and longer leads times, triggered an out of the box idea. Sigma initiated in-house making of alloys of metals, by using scrap. This has improved the metal chemistry thereby enhancing the output in terms of quality and cost and brought considerable flexibility to make a wide range of alloys.

Benefits : Backward integration – In house alloying in foundry, reducing Melting Cost by 20%





Low Cost Automation & Robotics

Sigma operates a proprietary Special Purpose Machine design and development center. SPMs are used to automate and mistake-proof (poka-yoke) many of the manual production processes required to produce parts once extracted from the mold. These highly customized and engineered machines substantially boost overall productivity and reduce costs. Many of the SPMs incorporate robotic production cells. The SPM development centre is being utilized to develop simple/Lean concepts for post foundry operations from shop floor /kaizen ideas to building SPMs which are lean/TPM friendly equipment Automation / Robots for de-burring – for critical products where visual quality requirements are stringent (Completed 11+ Robotic and Low Cost Automation in FY15. We plan to add 20 more Robotics and Low Cost Automation in FY16



Results

Lean manufacturing has helped us to visualize the present level of wastes occurring at Sigma and future possibilities of reducing or eliminating them. Different lean tools and techniques are used in order to

continuously reduce and eliminate waste. There has been high importance provided to train our employees in Lean. Lean has helped our foundries improve our financial performance and customer service, unlocking organizational value in the present VUCA (Volatile, Uncertain, Complex, and Ambiguous) environment.

Key Lean initiatives implemented in our foundries are 5S, our 5S Score improved from 3 to 3.81 on a 5 point scale and our aim is to exceed 4.0 in 6 months. Productivity improvement over 30%. Rejection improved up to 20%. Yield improved up to 44% for all dies and tools. Our on time deliveries improved from 80% to 95% and 99% in retail sector. We also implemented Backward Integration, i.e. in-house alloying by buying scrap which improved our melting cost by 20%. As a go green initiative, we have replaced all melting-cum holding furnaces (gas fired) to electric furnace. With an aim to meet visual and stringent quality requirements, we have executed in-house 11 automation and robotics projects and have a plan of incorporating 5 robotics and 15 low cost automation projects in financial year2016.

Sigma has achieved savings worth \$ 2.0 MM (INR 12 Crs) in the Fiscal Year 2015

Conclusion

The current practices of Lean Manufacturing are indeed eliminating waste with less human effort. In order to achieve efficient production and to eliminate waste it is necessary to understand and completely apply the lean tools and methodology presented in this paper. All these principles need to be followed not only by management, but also by the workforce. Additionally, lean thinking is leading to an increase in production efficiency by identifying and concentrating in activities that represent value for the customer. Those value added activities should be connected in the whole process and must flow through the entire production route. It is important to keep in mind that lean thinking applies the pull system, where everything is produced as per the customers’ needs. The customer pulls production and every workstation pulls requirements from the previous one based on the customer demand.