Process Planning Through Value Stream Mapping In Foundry

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ABSTRACT— A value stream is all the actions (both value added and non-value added) required to bring a product through the main flows essential to every product for the production flow from raw materials into the arms of the customer and to design the flow from concept to launch as a lean manufacturing tool. Taking a value stream perspective means working on the big picture, not just individual processes and improving the whole not just optimizing the parts. In this paper, in a casting foundry with results are considered with current state maps and future state maps after following the different steps starting from the detailed time study for mapping the processes from raw materials to final product. When we engage in true process improvement, we seek to learn what causes things to happen in a process and to use this knowledge to reduce variation, remove activities that contribute no value to the product or service produced, and improve customer satisfaction. Process improvement means examine all of the factors affecting the process, the materials used in the process, the methods and machines used the transform the materials into a product or service, and the people who perform the work. Lean production starts from the arguments that adding value and reducing waste. Value stream mapping is different than conventional recording techniques, as it captures the information at individuals stations about station cycle time, uptime or utilization of resources, setup time, WIP inventory, manpower requirement and the information flow from raw materials to finished goods. This paper details the use of the value stream mapping in reducing waste in manufacturing company. With a case study in a one of the casting industry, the production process path is visualized by mapping the current state value stream map. After tracking the entire process, wastage affecting the cycle time are identified and its causes analyzed. A future state value stream map is developed and improvement ideas are suggested. Value stream mapping is proved as a useful technique to minimize the cycle time and increase the productivity.

KEYWORDS— Lean manufacturing, 5S, Value Stream mapping.

I. INTRODUCTION

Casting Industry is Located in Coimbatore, India and have been dominant player in the manufacturer of Horn end other products like Castings and Industrial Cleaning Machines. Since its establishment in 1970, Company had a vision and commitment to produce and deliver products adhering to International standards.

Casting Industry, a multi-faceted industrial conglomerate in this part of the country with a tradition, for over three decades of the excellence in automobile parts, industrial products and engineering that values and believes in the power of people much more than technology. It is a company that is built on the principles of ethics and human values on a solid footing. Its commitment to quality systems and society could be seen in the No.1 position it ranked in getting ISO, QS, ISO/TS 16949 and ISO 14001 in the regional, national and international levels.

II. LITERATURE REVIEW

Lean Manufacturing can be thought of as a systematic approach to reducing waste in the production process. In this sense, waste is anything (activities, processes, tools, materials, personnel) that does not add value to the product or service as viewed by the customer.

In the 1940s Taiichi Ohno & Shigeo Shingo improved upon previous manufacturing breakthroughs like interchangeable parts, time and motion measurement,
assembly lines-to create the Toyota Production System (TPS), the principles and practices of which eventually also became known as Just-in-Time manufacturing (JIT). This groundbreaking thinking catapulted Toyota into the global spotlight, and its processes became premier industry practices that everyone aspires to emulate. Because TPS pares manufacturing down to the bare essentials needed for high-quality production, the approach took on yet another telling name in the 1990s: Lean Manufacturing.

In an effort to better understand the true definition of waste, Lean divides the various types of waste into seven categories:

- Overproduction.
- Waiting.
- Transport.
- Over processing.
- Inventory.
- Movement.
- Scrap or defects.

Best thought of as symptoms of larger problems, the wastes are like the tips of icebergs. They indicate problems that are out of sight and that can run much deeper. Problems are compounded because, without TPS or Lean, manufacturers tend to treat symptoms only and rarely identify root causes. Original problems recur and new ones can even be created, because they just receive a quick fix and are not truly solved.

In a true Lean environment, inventory levels are reduced, hidden problems revealed, and solutions developed in a way that supports team concepts, collaboration, new ideas, and a common goal: satisfying the customer. This approach, and the results it produces, is one of the great differences between Henry Ford's breakthrough processes and Toyota's. Ford was very good at producing one specific type of automobile without variation. (He once famously said, customers could buy Ford cars in 'any color so long as it's black.') Toyota's processes, on the other hand, allow quick changes that result in delivery of specifically what the customer wants.

This different viewpoint has led many services companies to benefit from implementing Lean methods and eliminating waste. Many companies have tried, unsuccessfully, to duplicate the success of Toyota, even though they have even named their efforts after the recognized Toyota Production System. The companies that do benefit from Lean Manufacturing succeed in creating an environment that is totally supportive of the entire continuous improvement effort. They understand a core principle of Lean: Success is not simply using tools and strategies but using all assets of a company, especially its people.

III. PROBLEM DEFINITION

- The current process flow takes more time for delivering the product.

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- Decrease in Productivity due to increase in manufacturing lead time.
- Problems are identified in industry in terms of non value adding activities.
- Excessive movements and handlings allow damage and lead to reduction in quality.
- To reduce the lead time by using value stream mapping.

IV. METHODOLOGY

Step1: Detailed process study.
Step2: Data collection.
Step3: Analyzing the existing process flow.
Step4: Evaluate by using Value Stream Mapping tool.
Step5: Implement the new process flow.

Data Collection

- Takt Time

Working shift per day = 2
Working hours per shift = 8 hours
Available time per shift = 480 minutes
Tea break per shift = 2breaks * 10 minutes = 20 minutes
Lunch break per shift = 60 minutes
Down time per shift = 0
Net working time per shift = [available time-(breaks +break down)]
= 480-80
= 400 minutes
Net working time per day = 24000 * 1
Customer demand per day = 535 Nos
Takt time = Available production time/Total daily quantity required.
= 960/535
Takt time = 8 minutes
The Takt time required to meet the customer demand is Calculated & found to be 8 minutes.

C. Calculation

- **Uptime %**
  Uptime % = (Actual production time of a machine – Value added time / Availability time) * 100
  Actual production time of a machine:
  For a month = 30 days * 24 hrs * 60 min = 43200.
  Value added time = 46 min (Calculated value)
  Uptime % = [(43200 - 442) / 43200] * 100
  = 98.97 %

C. Current State Map

The production control information flow is shown to determine how the production processes are being scheduled and controlled. At the bottom of the Map, the total process time and lead time are calculated for a typical product family unit or order.

Fig. 3 Current state map

C. Case study after value stream mapping

The man power and machines are utilization is tabulated in table 2.

### Table I

<table>
<thead>
<tr>
<th></th>
<th>Melting</th>
<th>Die</th>
<th>Casting</th>
<th>Runner Breaking</th>
<th>Shot Blasting</th>
<th>Retting</th>
<th>Machining</th>
<th>Final Inspection</th>
<th>Packing</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cycle Time</strong></td>
<td>30 min</td>
<td>30</td>
<td>5 min</td>
<td>6 min</td>
<td>30 min</td>
<td>30 min</td>
<td>30 min</td>
<td>30 min</td>
<td>30 min</td>
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<tr>
<td><strong>Operator</strong></td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Up Time %</strong></td>
<td>98.97</td>
<td>98.97</td>
<td>98.97</td>
<td>98.97</td>
<td>98.97</td>
<td>98.97</td>
<td>98.97</td>
<td>98.97</td>
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</tr>
<tr>
<td><strong>Availability</strong></td>
<td>960 min</td>
<td>960</td>
<td>960 min</td>
<td>960 min</td>
<td>960 min</td>
<td>960 min</td>
<td>960 min</td>
<td>960 min</td>
<td>960 min</td>
</tr>
</tbody>
</table>

**B. Future state map**

The Future State Value Stream Map shows how the shop floor will operate after lean improvements have been implemented. The Current State Value Stream Map serves as the starting point for developing the Future State. The goal in developing the Future State Map is to make the flow continuous and to eliminate as much waste as possible. Lead time is shortened as much as possible by implementing lean techniques. The flow in the Future State Map is built around the takt time, or how frequently a unit must be completed to meet customer demand. Takt time is simply the available working time per shift divided by the rate of customer demand per shift.

**C. Case study after value stream mapping**

The man power and machines are utilization is tabulated in table 2.
TABLE 2

<table>
<thead>
<tr>
<th>Method</th>
<th>Area:</th>
<th>Cycle Time</th>
<th>Operation</th>
<th>Lead Time</th>
<th>Availability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Die Casting</td>
<td>10 min</td>
<td>10 min</td>
<td>10 min</td>
<td>1 min</td>
<td>100%</td>
</tr>
<tr>
<td>Pouring and Breaker</td>
<td>12 min</td>
<td>12 min</td>
<td>12 min</td>
<td>1 min</td>
<td>100%</td>
</tr>
<tr>
<td>Shot Blasting</td>
<td>15 min</td>
<td>15 min</td>
<td>15 min</td>
<td>1 min</td>
<td>100%</td>
</tr>
<tr>
<td>Fettling</td>
<td>20 min</td>
<td>20 min</td>
<td>20 min</td>
<td>2 min</td>
<td>100%</td>
</tr>
<tr>
<td>Machining</td>
<td>25 min</td>
<td>25 min</td>
<td>25 min</td>
<td>3 min</td>
<td>100%</td>
</tr>
<tr>
<td>Final Inspection</td>
<td>30 min</td>
<td>30 min</td>
<td>30 min</td>
<td>3 min</td>
<td>100%</td>
</tr>
<tr>
<td>Packing</td>
<td>35 min</td>
<td>35 min</td>
<td>35 min</td>
<td>4 min</td>
<td>100%</td>
</tr>
</tbody>
</table>

X. CONCLUSION

This paper delivers the evidence of valid advantage when applying lean principle to the Shopfloor. By applying 5s technique resulting effective organization of the workplace, reduction of work’s environment, elimination of losses connected with failures and breaks, improvement of the quality and Safety of work. From VSM to remove the non-Valued activities during manufacturing and also to reduce manufacturing lead time. The Proposed process will overcome the drawbacks of the existing process with complete functionalities and quick respond time. This Process will be very effective and we hope that they will implement in future.

REFERENCES