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## LEAN MANUFACTURING: RELEVANCE IN AUTO SECTOR

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### ABSTRACT

The Manufacturing industries have gone through significant change in the last two-three decades and the competition has increased very rapidly. The main focus of the customers is on product quality, product delivery time and the cost of product. Lean Manufacturing is an end-to-end collection of processes that create value for the customer. The value stream is the entire creation process for a product. The value stream starts at concept and ends at delivery to the customer. In Lean Manufacturing, the value of product is defined solely by the customer. Lean is a systematic approach to identify and eliminate waste through continuous improvement following the product at the pull of customer in pursuit of perfection. Value added activities make the product more closely resemble what the customer wants. Non value added activities do not create customers value. Anything that is not adding value is defined as waste. Value Stream Mapping (VSM) is an important tool for implementing Lean philosophy. VSM is a method to describe the flow of material and information through the production system. In addition it requires close monitoring of processes to reduce process variability (defect free production), efficient planned maintenance of all machines (for increased availability) and reduction in non-value added activities such as setup times, movement of material in between the work processes and additional processing of material.

**Keywords:** Lean, VSM, Waste, 5s.

### I. INTRODUCTION

**1.1 The Logic of Lean:** In Lean, one pursues understanding the source and rooting out the causes of waste. The practice of Lean as the root-cause eliminator of wastefulness is based on a core set of fundamental assumptions.

**1.2 Where is Lean? :** Lean is found wherever there is waste, and anywhere there is opportunity for improvement. In other words, Lean is found everywhere. It's not confined to any particular part of the organization or function of the enterprise. Although formal Lean practices began in manufacturing, they apply across the board. Lean is a business-improvement initiative, best applied enterprise-wide. A common misconception holds Lean as a sort of manufacturing quality program. Not so. The philosophy, principles, and practices of Lean are applicable anywhere, and they are most effective when applied across the entire organization.

**1.3 Lean Production or Lean Manufacturing:** Early in the formalization of Lean techniques, the practices were modeled after manufacturing and production approaches in companies like Toyota. Enormous successes ensued in other manufacturing companies as Lean practitioners applied the techniques in other

manufacturing environments. As a result, these Labels took hold.

**1.4 Lean Office and Lean Administration:** These references note that the practices have been applied with great success in office environments, where the value streams are policy-based, information-oriented decision making and involve the effective management of transactions and data.

**1.5 Lean Management:** This term is most often associated with the role of managers in the Lean enterprise. This covers the management of a Lean initiative, as well as the personal Lean practices of the managers themselves.

**1.6 Lean Thinking:** Because Lean is more than just tools and techniques, people within an effective Lean organization apply Lean practices as a way of thinking a way of approaching issues and challenges. After you've truly adopted the ways of Lean, you'll be a Lean thinker. Think of Lean in the enterprise not as a group of functional or departmental practices, but as a set of multidisciplinary practices that cross functional lines. Lean focuses on the processes that create customer value, which by their nature are cross-functional. Examples include the supplier-assembler process, the assembler distributor-customer process,

the marketing-design development process, the company-shareholder process, and the company government- regulatory process. In each of these cases, work is not aligned by classic Western-style functional departments. Instead, the process is facilitated by multidisciplinary teams and in a Lean enterprise; the individuals on these teams are cross-trained as well.

**II. THE SOURCES OF WASTE**

- **Using more raw material than necessary** Not only are you buying, transporting, and storing the extra raw material in the first place, but you then have to pay to transport and dispose of damaged or obsolete goods.
- **Spending more time to develop and produce your products and services** You're not just making the customer wait you're also



**Fig. 1: Sources of Wastages in a Production System**

Consuming energy, wasting people’s time and using facilities to store and move around materials and work and there’s the opportunity cost of delayed payment.

- **Making mistakes** Not only are mistakes frustrating to you, your coworkers, and your management, as well as the customer, but you have to spend more time and use more materials doing it over.
- **Overproducing and carrying excess inventory** Excess inventory directly wastes space. Plus, it has to be handled and maintained. And what’s the sense in making more than you are selling?

- **Using more space than necessary** Space is facility and capital cost, as well as the energy and labor to maintain it.
- **Spending more money than necessary** It doesn’t take an accountant to know that spending more money than you should to get something done is wasteful!
- **Using more equipment and tools than necessary** Not only are those extra tools and equipment expensive, but they also have to be stored, repaired, and maintained.
- **Involving more people than necessary** People are extremely valuable and expensive, and they should be engaged in doing only what’s most important.
- **Having incorrect or incomplete information or instructions** It results in mistakes, rework, scrap, lost time, and missed deadlines plus, it can be hazardous
- **Having people work improperly** This is the most wasteful of all. Not only is it a direct waste of time and effort, but it’s damaging to the psyche and to morale. It’s also potentially physically harmful and dangerous.

**Table1.1 Type of Waste Targeted by Lean Methods**

Waste Type	Examples
Inappropriate Processing	Production of off-specification products, components or services that result in scrap , rework, replacement production, inspection and defective materials
Waiting	Delay associated with stock outs, lot processing delay, equipment downtime, capacity bottlenecks
Over Processing	Process steps that are not require to produce the product
Overproduction	Manufacturing items for which there are no orders
Transportation	Human motions that are unnecessary or straining and WIP transportations long distances

Excess Inventory	Excess raw material , WIP , finished goods
Extra Motion	More parts, process steps or time that necessary to meet customer needs

### III. LEAN MANUFACTURING PRINCIPLES

The Five Lean manufacturing principles given by Burton and Boeder (2003) are as under

- **Value** Define value from the standpoint of the customer. However, in reality, the final customer is the only one who can specify the value of a specific product or service by paying a price for it.
- **Value stream** View your product delivery system as a continuous flow of processes that add value to the product.
- **Flow** The product should constantly be moving through the value stream towards the customer at the pace of demand.
- **Pull** Product should be pulled through the value stream at the customer’s demand rather than being pushed on to the customer
- **Perfection** The never-ending pursuit of eliminating waste in the system such that the products can flow seamlessly through the value stream at the rate of demand.

Thus, Lean is basically all about getting the right things, to the right place, at the right time, in the right quantity while minimizing waste and being flexible and open to change.

### IV. LEAN MANUFACTURING STRUCTURE, TOOLS & TECHNIQUES

Various key Lean tools and techniques are discussed one by one below and shown in diagram below. Key Lean tools are:-

- Kaizen
- 5 S’s
- Total Productive Maintenance (TPM)
- Cellular Manufacturing / One-Piece Flow Systems

- Just-In-Time (JIT) Production Systems/ Kanban
- Production Smoothing
- Standardization of Work
- Six Sigma
- Single Minute Exchange of Die (SMED)
- Value Stream Mapping



Fig. 2: Structure of VSM Based Lean Production System

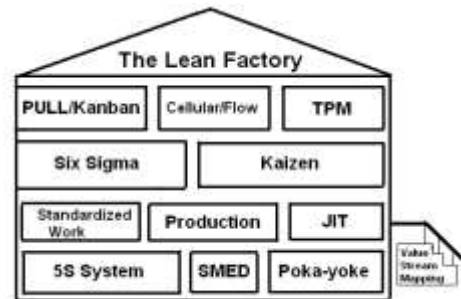


Fig. 3: Key Lean Tools

### V. VALUE STREAM MAPPING

A value stream is all the actions (value-added and non-value added) required to take a product from raw material to the customer, the design flow from concept to completion. Taking a value stream view means looking at the whole picture, not just individual processes, and improving the whole, not just individual parts. Value Stream Mapping is a pencil and paper tool that helps to see and understand the flow of material and information as a product makes its way through the value stream. The meaning is simple Follow a product's production path from customer to supplier, and draw a visual picture of every process in the material and information flow. Within the **production flow**, the movement of material through the factory is the flow that usually comes to mind. But

the **information flow** must also be considered since it tells each process what to make or do next; both flows must be mapped.

**5.1 VSM as a Planning Tool:** Value Stream Mapping can be a communication tool, a business-planning tool, and a tool to manage change in production processes. The first step is drawing the current state, done by gathering information on the plant floor. This provides the information needed to map a future state. The final step is to prepare and begin actively using an implementation plan that describes, on one page, how the future state can be achieved. More organizations with successful plant Lean programs are also applying Value Stream Mapping methods and Lean principles to administrative areas. Value Stream Mapping provides a simple, yet thorough method that relies on current data analysis and display. It links reporting requirements, metrics, people, and Lean tools to continue improvement and promote process learning. It gives managers and employees the same tool and language to communicate.

**5.2 What is Value Stream Management?** Value Stream Management is an orderly approach that allows plant personnel the opportunity to plan how and when they will make the improvements required to meet customer needs. VSM is not about making people **work harder**, but **working smarter**. It is setting up a system for material to flow smoothly through the various manufacturing processes at the speed required to meet customer demand.

Value Stream Management

- Ties people, Lean tools, metrics, and reporting requirements together for a Lean enterprise.
- Requires a Lean coordinator to make the process go smoothly and ensures that Lean is continuous.
- Let's everyone understand and continuously improve the understanding of Lean concepts.
- Makes for a controlled process flow on the floor for an actual Lean implementation plan.

**5.3 Value Stream Management Purpose:** Value Stream Mapping is one of the latest trends to improve manufacturing processes, because Value Stream Maps are an important part of what makes the storyboard an exceptional form of visual management. Without a good understanding of Lean Manufacturing principles, mapping will not bring companies closer to reducing wastes and achieving excellence than early experimentations with Kaizen workshops. Many manufacturers recognize the many benefits of Lean

manufacturing, only a few understand what must go into this effort to make it successful. Experience has shown that a successful Lean program depends on four main factors

- Make a true commitment to the success of the Lean program.
- Understand exactly the specifications of the customer's requirements.
- Illustrate the current state as accurately as possible.
- Effectively communicate to everyone involved on the team and involved in the program.

**5.4 Activities in Value Stream Mapping:** Before giving the definition of VSM it is important to understand what Value and Value Stream is. Focus on value in the context of what the customer/end-user is prepared to pay for. To carry out this activity the company needs to understand what the customer requires in terms of features and performance, and how much they are willing to pay for the product. The outcome of this activity is a clear understanding of what products the customer requires. These requirements may not be feasible immediately, but it provides a true representation of customer need. Value stream is the entire creation process for a product. The value stream starts at concept and ends at delivery to the customer. Every stage the product goes through should add value to the product, but often this is not the case. Mapping of the value stream aids the identification of value adding and non-value adding (i.e. waste) activities; some examples are listed below.

#### Value Adding Activities

Machining, Processing, Painting, Assembling

#### Non value adding Activities

Scrapping, Sorting, Storing, Counting and Moving.

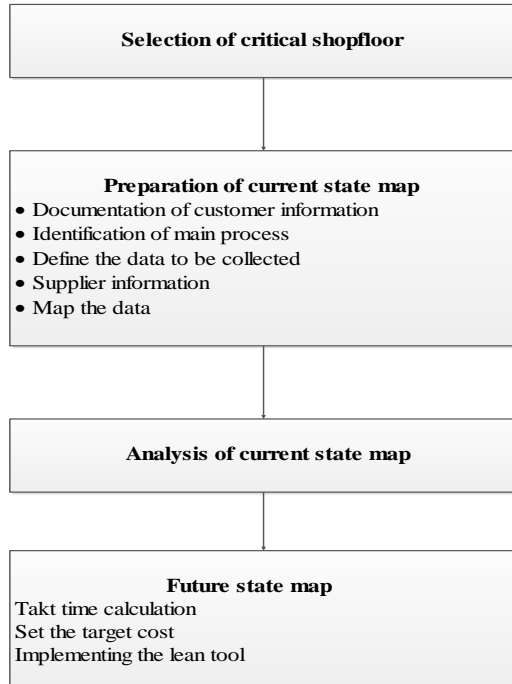


Fig. 4: VSM Implementation Flow Chart

## VI. CONCLUSION

It is rightly argued that whenever there is a product for a customer, there is a value stream. This powerful tool only highlights process inefficiencies, transactional and communication mismatches but also guides about the improvement areas.

## VII. LIMITATION OF STUDY

While applying VSM concepts some precautions should be observed. Since it gives a pictorial view of the process at any particular instant of time, it may capture the wrong picture at that particular instance, which may mislead decision makers. Secondly, VSM only hints about the areas of improvement. In present study the variables chosen are in process inventory, station cycle time and lead time but no study is being carried out on change over time, workers attitude and working environment. Further no cost benefit analysis of the modifications made is carried out.

## VIII. SCOPE OF FUTURE WORK

The present study has following scope for future work

- This study can be extended by adding more variables like change over time, workers attitude and work environment.
- VSM techniques can be also being applied on service industry.
- Cost benefit analysis of the modifications made in current state map can also be carried out.
- VSM technique can also be applied to some other product line.
- Software can be developed to make the VSM more effective.

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