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Analyze the Value Stream Mapping for Lead Time Reduction by Lean: A Review

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Abstract

Toyota started practicing TPS (Toyota Production System) since 1950, successfully. Due to success of TPS, many companies across the world started using the same. Later in 1990s, Womak and Jones gave the name it as a lean manufacturing. Lean manufacturing is now one of the most powerful manufacturing systems in the competitive world. Numerous organizations around the world have implemented and adopted it to enhance their productivity through reduction and elimination of waste. This project reports is on understanding and implementation of one of the lean tools which is; value stream mapping, for directional control valve in Bosch Rexroth (India) Pvt. Ltd., Sanand Plant, Ahmedabad. Value stream mapping is a lean tool to identify the value added and non-value added activity during the production. Using this, identifying the waste and removing it along the processes, which is based on the principle of Bosch production system is done. TPS (Toyota Production System) intends the checking of the inventory level during the process of manufacturing and assembling of the products.

Keywords: *Value Stream Mapping, lean tool, elimination of waste, TPS*

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INTRODUCTION

Lean manufacturing is a philosophy in which it is used for elimination of waste; lean means manufacturing without waste. Waste ("muda" in Japanese) has seven types: waste from overproduction, waste of waiting time, transportation waste, inventory waste, processing waste, waste of motion, and waste from product defects. The goals of lean manufacturing are to reduce waste in human effort and inventory, reaching the market on time, and managing manufacturing stocks that are highly responsive to customer demand while producing quality products in the most efficient and economical manner.

The concept of lean manufacturing originated from Toyota production system (TPS) that determined the value of any process of two activities; value-added activities from non-value-added activities; and eliminating waste, so that every step adds value to the process. Lean manufacturing focuses on efficiency, aiming to produce products and services with minimum or without waste, at the lowest cost and as fast as possible [1]. For lean manufacturing, Kanban serves as a tool to control the levels of buffer inventories in the production; in simpler terms, to regulate production quantities. When a buffer reaches its preset maximum level, the upstream machine is directed to stop producing that part type. Hence, in the manufacturing environment, Kanban are signals used to replenish the inventory of items used repetitively within facility [2].

LEAN PRINCIPLES

Basically there are five rules for implement the lean manufacturing.

1) Specifying Value: Value is defined by the customer. It is only meaningful when it express in terms of specific product or service which meets the customer need at a specific price at a specific time.
2) Identify and create Value Stream: A value stream is, all the actions currently required to bring a product from raw material to customer getting.
3) Making value flow: Product should flow through a lean organization at the rate that the customer needs them without being

caught up in inventory.

4) Pull Production not Push: Only make as required. Pull the value according to the customer's demand.
5) Striving for perfection: perfection does not just mean quality. It means producing exactly what the customer wants, exactly when the customer requires.

LEAN TOOLS

5S

Table 1:

What	How
SEIRI (SORTING)	Differentiate necessary and unnecessary items, Discard unnecessary items
SEITON (SET IN ORDER)	Placing things, based on the frequency of usage, Arranging things so that it is easy to locate
SEISO (SELF CLEANING)	Removing dust, dirt and contamination and keeping cleanliness, Keeping the environment always clean, beautiful and free from trash and dirt
SEIKETSU (STANDARDIZE)	Keeping and maintaining the previous 3S on regular basis, Keeping hygienic and clean environment
SHITSUKE (SUSTAIN)	Maintain a habit to keep the resolutions rightly and forever. Carryout work in accordance with set standards

GEMBA

The Japanese term for "Actual place," often used for the shop floor or any place where value-creating work actually occurs. The term often used to stress that real improvement only can take place when there is shop-floor focus based on direct observation of current condition where work is done [3].

JIDOKA

The term Jidoka used in the TPS can be defined as automation with a human touch, as opposed to a machine that simply moves under the monitoring and supervision of an operator. The Toyota term "Jido" (automation) is simply applied to a machine that moves on its own. Jidoka is one of the two pillars of Toyota production system along with just in time (JIT).

JIT

A system of production that makes and delivers just what is needed, just when it is needed, and just in the amount needed. JIT and Jidoka are two pillars of Toyota production system. JIT aims for the total elimination of all waste to achieve the best possible production and delivery lead times.

KANBAN

The Kanban system determines the production quantities in every process. In Japanese, the word "Kanban" means "card" or "Sign" and is the name given to inventory control card used in pull system. It is upstream process which produces only enough unit to replace those that have been withdrawn by the downstream process.

Muda

Waste is one of the seven wastes identified by Toyota. These are:

1. Overproduction: Producing items for which there are no orders.
2. Waiting Time: Employees standing about. Inventory at stand-still.
3. Unnecessary Transport: Moving material unnecessarily or long distances.
4. Over-processing: Using more steps to produce a product than necessary.
5. Excess Inventory: Retaining unnecessary inventory between process steps.
6. Unnecessary Movement: Any wasted motion by man or machine.
7. Defect: Making incorrect product.

OEE (Overall Equipment Effectiveness)

OEE is defined as a measure of utilization for an equipment for the time it is planned to be used. It excludes all planned downtimes, but includes setups or change over losses. In effect implying, how effectively planned time was used for producing good parts. OEE typically focuses on six major losses: failure, adjustment, minor stoppages, reduced operating speeds, scrap and rework.

PDCA

Plan: Senior management uses the visioning process in the context of its business plan.
Do: Implementation of action plans.

Check: On a periodic basis, review the measurement of the outputs, and note what learned can help in the future.
Act: Necessary adjustments to plans and priorities to ensure the success of the strategy breakthroughs.

Poka Yoke
It is an error proofing method. In which error or mistake is easily identified using the signals.

Root Cause Analysis
It is also known as Ishikawa diagram or fishbone diagram. It is a method to find and derive the all possible causes or root causes behind any uncertainty.

SMED
SMED stands for single change exchange die. It is theory and set of techniques that make it possible to perform equipment setup and changeover operations in less than 10 min.

VSM
All the actions, both value adding and non-value adding required to bring a product from concept to launch and from order to delivery. These include actions to process information from the customer and actions to transform the product on its way to customer.

If all these tool are being implemented in your industry, then you can say your company is successfully implementing lean manufacturing. Among them, my project report is on value stream mapping for lean manufacturing in industry; so now we discuss value stream mapping.

WORK BOUNDARY

VALUE STREAM MAPPING

A value stream is, all the actions which include both, value added and non-value added actions currently required to bring a product through the main flows essential to every product. There are two kinds of main flows (Processes) in any organizational setup.

- The product flow from raw material into the arms of the customer.
- The design flow from concept to launch.
- The information flow from customer to supplier.

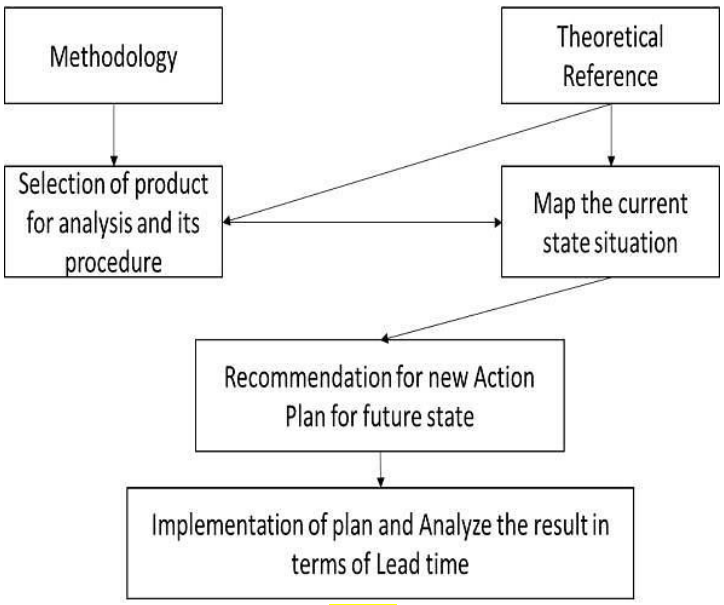


Fig. 1:

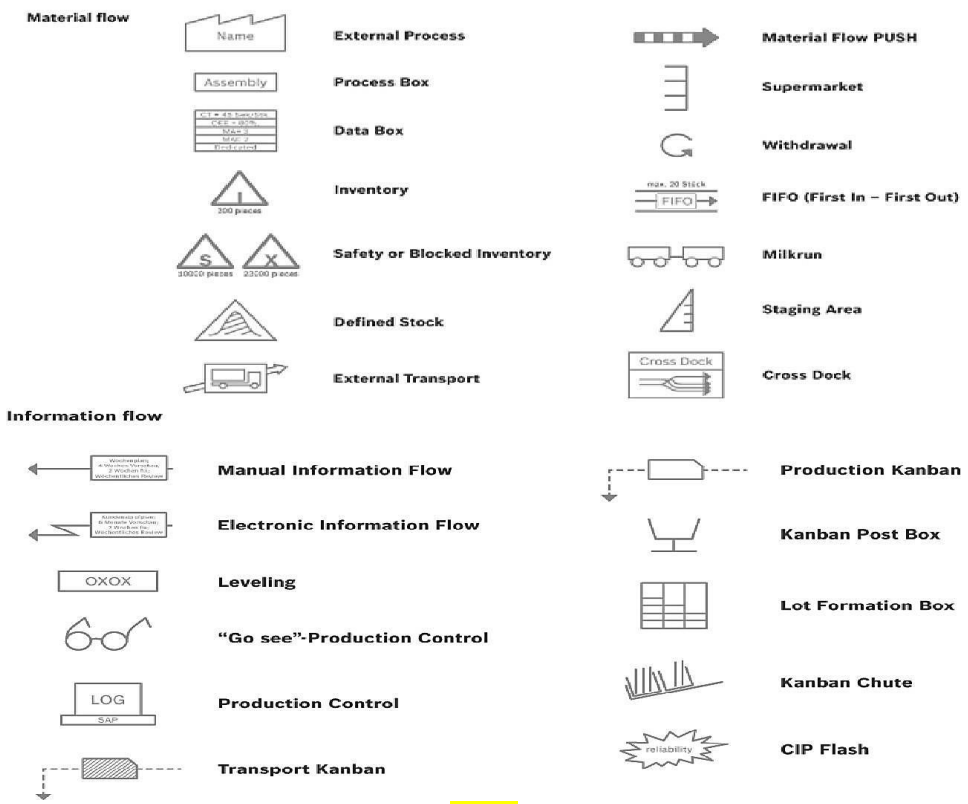

Material flow
Name
External Process
Assembly
Process Box
Data Box
Inventory
200 pieces
Safety or Blocked Inventory
10000 pieces
20000 pieces
Defined Stock
External Transport
Material Flow PUSH
Supermarket
Withdrawal
max. 20 Stück
FIFO
FIFO (First In – First Out)
Milkrun
Staging Area
Cross Dock
Cross Dock
Information flow
Manual Information Flow
Electronic Information Flow
OXOX
Leveling
"Go see"-Production Control
LOG
SAP
Production Control
Transport Kanban
Production Kanban
Kanban Post Box
Lot Formation Box
Kanban Chute
reliability
CIP Flash

Fig. 2:

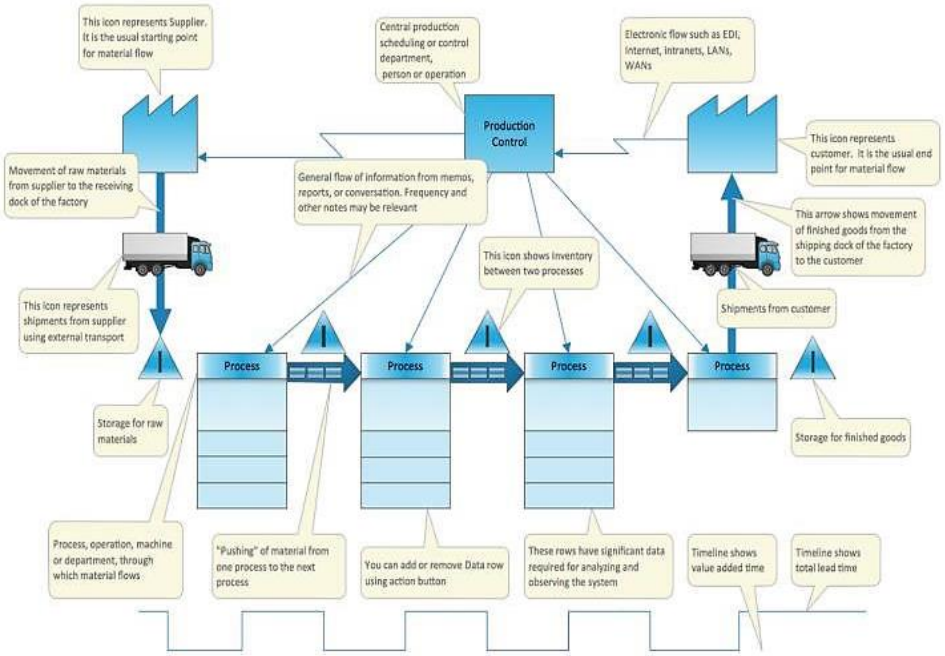

This icon represents Supplier. It is the usual starting point for material flow
Central production scheduling or control department, person or operation
Electronic flow such as EDI, Internet, Intranets, LANs, WANs
Production Control
This icon represents customer. It is the usual end point for material flow
Movement of raw materials from supplier to the receiving dock of the factory
General flow of information from memos, reports, or conversation. Frequency and other notes may be relevant
This arrow shows movement of finished goods from the shipping dock of the factory to the customer
This icon shows inventory between two processes
This icon represents shipments from supplier using external transport
Shipments from customer
Process
Process
Process
Process
Storage for raw materials
Storage for finished goods
Process, operation, machine or department, through which material flows
"Pushing" of material from one process to the next process
You can add or remove Data row using action button
These rows have significant data required for analyzing and observing the system
Timeline shows value added time
Timeline shows total lead time

Fig. 3:

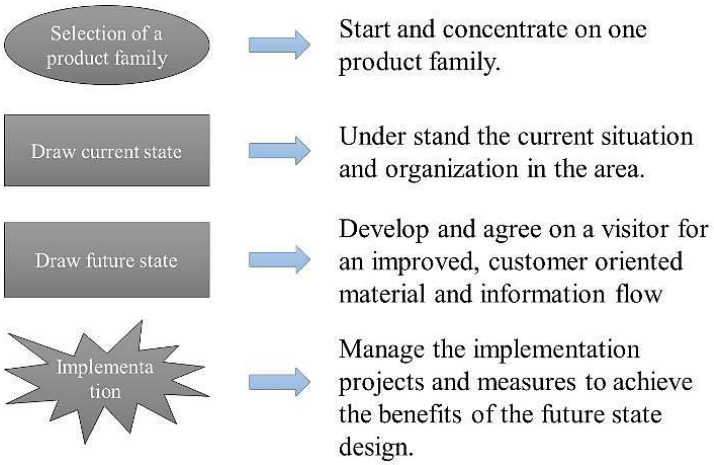
Value Stream Symbol

Value stream mapping is a method of lean manufacturing which uses symbols, metrics and arrows to show and improve the flow of material and information required to produce a product or service which is delivered to a consumer. A value stream map is a visual representation which enables one to determine where the waste occurs. Value stream maps are utilized to assess current manufacturing processes and create ideal and future state processes. Value stream mapping is a tool which maps the process flow that helps in identifying various factors like [4];

- Value added time (time taken for producing the end product),
- Non-value added time (time taken which do not contribute to the production of end product),
- Cycle time (time required to perform a process) and
- Changeover time (time required to change tool and programming etc.).

V alue Stream Template

VSM Steps



CONCLUSION

From the literature reviewed it concluded that lean manufacturing techniques promise to enhance the productivity by reducing the parameters like lead time, inventory level, production cost and material usage and delivery to a noticeable extent and also it resulted in increased Quality. It also depicts that amongst the various mapping techniques analyzed, VSM is an approach which proves to be more suitable in complex working environments, which not only helps in identifying the wastes hindering the productivity but also helps one to identify the right lean tools to be used for the given situation.

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