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LEAN MANUFACTURING USING STANDARD OPERATIONS PROCEDURES AND SETUP ANALYSIS AS TOOLS

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ABSTRACT

In today's fast moving, complex business environment manufacturing becomes a commodity within the value chain. In such an environment there is need to focus on creating efficiencies that drive down the products costs. World's largest automobile manufacturers to the World's largest computer manufacturer are now focusing on 'leaning' their manufacturing operations.

Lean manufacturing principles provide an excellent framework for squeezing costs out of manufacturing. However, lean manufacturing by itself is not enough for success. In this paper it is presented that in today's volatile demand fragmented supply environments, we must combine lean manufacturing principles with Standard operating procedures (SOP's). By doing this we can understand and address the causes of variability and manage the exceptions better.

These two principles working in unison will provide enough flexibility to allow responding demand and supplying uncertainties. These will also add tremendous value and are essential ingredients to drive manufacturing costs and time efficiencies.

INTRODUCTION

WHAT IS LEAN?

"A systematic approach to identifying and eliminating waste (non-value-added activities) through continuous improvement by flowing the product at pull of customers in pursuit of perfections".

"A manufacturing philosophy that shortens the time line between the customer order and shipment by eliminating waste (non value adding activities)".

Lean manufacturing is doing more with less of,

- Materials, time, resources.
- Overhead, people.
- Waste
- Money

Lean manufacturing improves operating performances by focusing on the quick and uninterrupted flow of products and materials through the value stream. To achieve this, the various forms of manufacturing waste must be indentified and eliminated. Waste can include any activity, step or process that does not add value for the customer.

LEAN THINKING PRINCIPLES

Under lean systems, the plant is highly customer focused, providing the highest quality, lowest cost products in the least amount of time. Lean thinking can be summarized in five principles (lean thinking keys) :

1. Precisely specify value by specific product.
2. Identify the value stream for each product.
3. Make the value flow without interruptions.
4. Let the customer pull value from the producers.
5. Pursue perfections.

If managers apply these concepts collectively, they can reap full benefit of lean techniques and significantly improve their product's competitive edge. Each principle is discussed below:

VALUE: Value is defined by the customer and is only meaningful when expressed in terms of a specific product, which meets the customer's needs at specific price and at a specific time. The error many producers make is internally defining value. They are internally focused and the value is lost. What they should be doing is rethinking value from the perspective of the customer. Lean thinking must ignore existing assets and technologies and rethink business on a product-line basis with strong, dedicated product teams.

VALUE STREAM: The value stream is all the steps and processes required to bring a specific product from raw materials to finished products in the hands of the customer. Analyzing the entire flow of product will almost always reveal enormous amounts of waste and non-value added sequences. This frequently referred to as process reengineering.

FLOW: Once value has been precisely specified, the value stream for a specific product fully mapped by the enterprise, and wasteful steps eliminated. It's time to make the remaining steps flow. It is common sense to perform like activities in batches where products flow through different sequences and operations in batches. This creates wait times while the product waits for the next operation or sequences, or departments changeover to the type of activity the product needs next.

PULL: The results of converting from departments and batches to product teams and flow is that the times required to go from concept to launch, sale to delivery, and raw material to the customer fail dramatically. When flow is introduced, products requiring years to design are done in months, order taking days to process are completed in hours; and the weeks and months of throughput time for conventional physical production are reduced to minutes or days. Truly lean systems can make any product currently in production in any combination such that shifting demand can be easily accommodated immediately. "You can let the customer pull the product from you as needed rather than pushing them the product" often unwanted. Customer demand becomes much more stable when customers know they can get what they want when they need it and when producers stop periodic price discounting campaigns designed to sell goods already made that no one wants.

PERFECTIONS: As the organization begins to accurately specify value, identify the entire value stream, make the value-added steps for specific products to flow continuously, and let customers pull value from the enterprise, something remarkable surfaces. People begin to realize there is no end to the process of reducing effort, time, space, cost and mistakes while offering a product. Perfection, the fifth and final principle of lean thinking.

CLASSIFICATION OF WASTE

- Value Added Activity (VA): An activity that transforms or shapes raw materials or information to meet customer requirements. These include all the activities that the customer envisions are valuable either in a product or as a service.
- Non Value Added Activity (NVA): An activity that uses time, resources or space, but

does not add value to the value of the product itself.

- Essential Non Value Added Activity (ENVA): Those non- value added activities that must be performed in order to finish a product. These activities can be eliminated completely, therefore the focus is on "reducing" them.
- Non Essential Non Value Added Activity (NENVA): Activities that do not add value or finish a product. These can be eliminated. These activities are pure waste and should be targeted for immediate removal.

WASTE

Waste is anything that does not value for the customer. There are mainly eight wastes of lean which are as follows:

- Defects
- Overproduction
- Waiting waste
- People waste
- Transportation waste
- Inventory/storage waste
- Motion waste
- Processing waste

WHY LEAN?

- Potential bottom line benefits
- WIP inventory reduction up to 90%
- Space utilization improvement up to 70%
- Lead time reduction up to 95%
- Productivity improvement of 10 to 40%
- Quality improvement of 25% to 75%
- Enhanced teamwork, communication
- Enhanced flexibility, visibility
- Survival and world-class status

LEAN MANUFACTURING TOOLS AND TECHNIQUES

Value Stream Mapping

A value stream is a collection of all action values added as well as non-value added that are required to bring a product or a group of products that use the same resources through the main flows, from raw materials to the arms of the customers. These actions are those in the overall supply chain including both information and operation flow, which are the core of any successful lean operations. Value stream mapping is an enterprise movement tool to assist in visualizing the entire production process, representing both material and information flow.

The goal is to identify all types of waste in the value stream and to take steps to try and eliminate them. Taking the value stream viewpoint means working on the big picture and not individual processes, and improvising the whole flow and not just optimizing the pieces.

Standardized Work (Standardized Operation Tools)

A very important principle of waste elimination is the standardization of worker actions. Standardized work basically ensures that each job is organized and is carried out in most effective manner. No matter who is doing the job, the same level of quality should be achieved. At Toyota every worker follows the same processing steps all the time. This includes the time needed to finish the job, and the parts on hand. By doing this one ensures that line balancing is achieved, unwarranted work-in-process inventory is minimized and non-value added activities are reduced.

Standardized operations are the documentation of how people and machines produce a part in a work cell while minimizing all forms of waste.

STANDARDIZED OPERATIONS

A tool utilized in flow production to assure maximum performance with minimum waste through the best combination of people, their environment and machine.

Standardized operations are…

- A prescribed sequence of production\process steps
- Assigned to a single operator
- Which are balanced to takt time.

Standardized operations details are…

The motion of the operator.

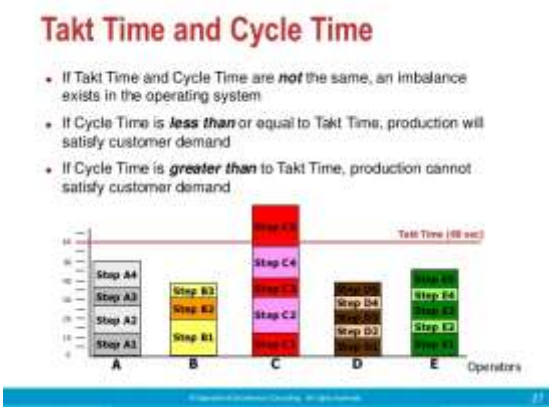
the machine processing sequence.

needs to be dynamic not static.

Standardized operation goals are to minimize and control the variation of:

- Output
- Quality
- WIP
- Cost

STANDARDIZED OPERATIONS CYCLE



METHODOLOGY

COLLECTING DATA FOR THE EXISTING PROCESS

Data is collected for the existing processes on PU-5. For this, set-up process and operating process for all twelve kind of machines are observed, understood and noted down.

DOCUMENTING EXISTING WORK PROCEDURE

The existing work procedures of all machines are noted down based on the data collected while observing the processes.

PREPARING STANDARD OPERATING PROCEDURE

STUDYING EXISTING SET UP TIME

The existing set up process is video recorded in camcorder.

SET UP ANALYSIS

Analysis of existing work processes are done. Unnecessary waiting time is eliminated.

ADDING VISUALS

Pictures are taken for each and every step of the standard operating procedure written and are added to make them visually effective and understandable for any new operator.

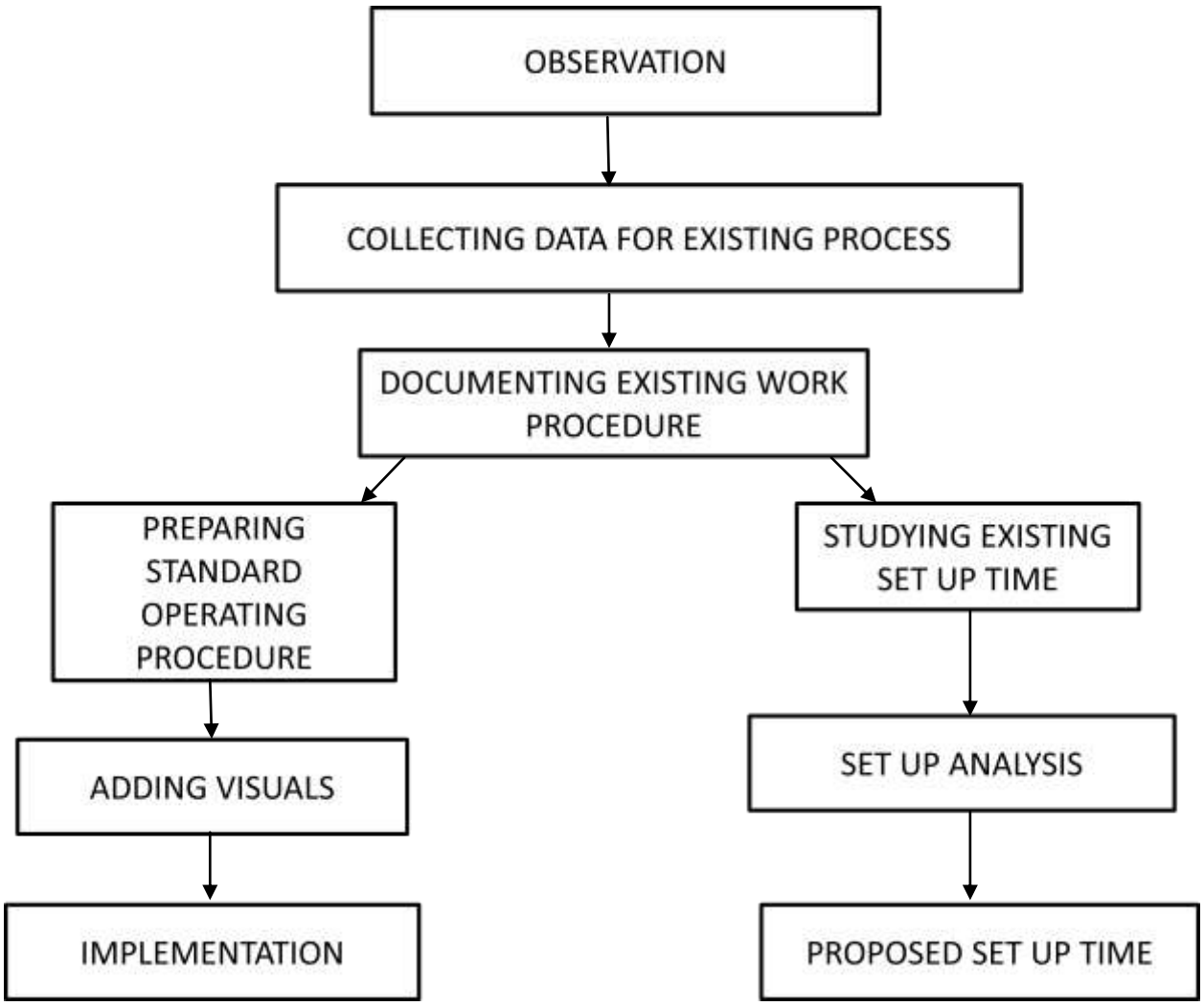
IMPLMENTATION

The newly made standard operating procedure are getting approved from senior engineers, maintenance department and shop floor manager is put up on machine enclosed folders.

The recorded existing set up process is then analyzed properly.

PROPOSING NEW SET UP TIME

The elemental activities are then analyzed.



CONCLUSIONS

Standard operating procedure was created by collecting data for the present processes, analyzing it and eliminating non-value added activities. Visual representations were added using a digital camera to make the standard operating procedures visually effective and easily understandable for a new operator.

Set-up analysis were done by video recording set up periphery grinding machine, top and bottom grinding machines and Pressing machines. Set-up analysis form was filled up by breaking the operations into smaller activities. Duration for each and every activity was noted, activities were differentiated into internal and external. Time was reduced by observing and externalizing internal activities.

- For periphery grinding machine there was a reduction of 28 minutes 12 seconds in set-up.
- For top and bottom grinding machine reduction in time for set-up was 8 minutes and 29 seconds.
- For press reduction in time for set-up was 17 minutes 35seconds.
- For periphery grinding machine the total annual cost saving is Rs.2,31,805 /-.
- For top and bottom grinding machine the total annual cost savings is Rs.3,85,560 /-.
- For press the total annual cost savings is Rs.5,88,609 /-.

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