Lean Manufacturing: Analysis of VSM, OEE and Implementation of 5s

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Abstract— Manufacturing is one of the prime sectors that has kept the world running for almost three centuries now. The technology has grown skyrocketing. As the technology became more advanced the customers demand increased and this in turn put a hit on many industries on their working schedule. Time I the key factor here. As to this, to meet the customer requirements in the given time many scholars and industrialist came up with different techniques and one successful method was lean manufacturing.
Here in this project we have implemented lean manufacturing to a cell through machine analysing and OEE monitoring and mapping the key process that defines the pay for the job. Initially we had noticed that the part process was not monitored regularly, and the part environment was not maintained. We have taken that into consideration and implemented 5S concept that will improve the cell efficiency.Value stream mapping is a concept that gives details about all the process that a part undergoes during the machining operation and makes it easy to identify all the value-added and non-value-added process so that we can make changes with regards to them. These concepts are time consuming; they are not a fast go process. they are implemented one by on which improves the overall factory efficiency step by step. We have taken all the parameters into consideration and have come up with a few of the best possible outcomes that can increase the production speed whilst maintaining the quality and customer satisfaction.

Key words – Lean manufacturing, overall equipment efficiency, tool management, value stream mapping, waste management, 5S

1 INTRODUCTION

Lean manufacturing is quasi process which gradually improve the performance and efficiency of the industry keeping in note that the factors like people, resource, effort, time and energy of the industry is optimized. A quasi process is a simple approach to runs an industry efficiently by incrementally improving and tweaking certain process.
Lean was first founded by FORD MOTOR COMPANY and then was implemented by Toyota, which made them lead the production system during the early 1950's.
After WW-II Japan was completely down to ashes and its financial status had reached grounds, during this period Toyota had to come up with a solution to increase their production rate and minimize their loss on waste and non-value-added process. Then came the idea that lead to lean manufacturing which made a drastic change not only in the company's margin but also the industrial development in Japan. Since then most of the industries have implemented this technique and are finding it beneficial.
Now with regards to our project at "MAINI precisions" is based on the same concept which involves applying lean manufacturing system and implementing value stream mapping to reduce the waste and track the production and optimising processing time. The most observed satiation in the industry is use of raw material more than the required amount and not meeting the target on time. The goal is as concerned which not only targets to rectify these issues but also build a smooth operating environment for the workers without imposing them with extra work just to achieve the determined goal.

On understanding these issues our aim is to minimize the waste generation, reduce unnecessary loss of time, make sure there occurs no sort of buffer in between processes and eliminate no value-added activities of any sort. With regards to this, the project has to take a look at the promising faces of lean ensuring that these parameters are achieved.

1.1 WHAT IS VALUE STREAM MAPPING?

VSM is a Special type of flow chart that uses symbols known as "the language of Lean" to depict and improve the flow of inventory and 2 information.

PURPOSE:

Provide optimum value to the customer through a complete value creation process with minimum waste in:

- Design (concept to customer)
- Build (order to delivery)
- Sustain (in-use through life cycle to service)

WHY?

Many organizations pursuing "lean" conversions have realized that improvement events alone are not enough Improvement events create localized 4 improvements, value stream mapping & analysis strengthens the gains by providing vision and plans that connect all improvement activities Value stream mapping & analysis is a tool that allows you to see waste, and plan to eliminate it.

1.2 PRINCIPLES OF LEAN MANAGEMENT:

1.2.1 Define Value

To better understand the first principle of defining customer value, it is important to understand what value is. Value is what the customer is willing to pay for.

1.2.2 Map the Value Stream

The second Lean principle is identifying and mapping the value stream. In this step, the goal is to use the customer's value as a reference point and identify all the activities that contribute to these values. Activities that do not add value to the end customer are considered waste.

1.2.3 Create Flow

After removing the wastes from the value stream, the following action is to ensure that the flow of the remaining steps run smoothly without interruptions or delays. Some of which are breaking down steps, reconfiguring the production steps, levelling out the workload, creating cross-functional departments, and training employees to be multi-skilled and adaptive.

1.2.4 Establish Pull

As mentioned previously, inventory is considered one of the biggest wastes in any production system. The goal of a pull-based system is to limit inventory and work in process (WIP) while ensuring that the materials and information are available for a smooth flow of work. A pull-based system allows for Just-in-time delivery and manufacturing, where products are created at the time that they are needed and in just the quantities needed.

1.2.5 Pursue Perfection

Wastes are prevented through the achievement of the first four steps:
1) Identifying value
2) Mapping value stream
3) Creating flow
4) Adopting a pull system.

However, the fifth step of pursuing perfection is the most important among them all. Every employee should strive towards perfection while delivering products based on the customer needs.

Fig 1.1 Lean principles

1.3 EIGHT TYPES OF WASTE:

According to the standards and close observations carried out from the beginning of lean, it is come to notice that there are almost 7 types of wastes (that can cost an industry more than the anticipated price as shown in fig: 1.2. They are classified as,
1. Over-production against time.
2. Waiting of operators and machines.
3. Unnecessary transportation.
4. Underutilization of people resources.
5. Excess stock of material and components.
6. Non value-adding motion.
7. Defects in quality.
8. Extra processing.

Fig 1.2 Eight types of waste

1.4 OVERALL EQUIPMENT EFFICIENCY:

It is the gold standard for measuring manufacturing productivity. Simply put – it identifies the percentage of manufacturing time that is truly productive. An OEE score of 100% means you are manufacturing only Good Parts, as fast as possible, with no Stop Time. In the language of OEE that means 100% Quality (only Good Parts), 100% Performance (as fast as possible), and 100% Availability (no Stop Time).
Components that determine the frame work of OEE availability Performa, quality.
It is **calculated** as: **OEE** = Availability × Performance × Quality. If the equations for Availability, Performance, and Quality are substituted in the above and reduced to their simplest terms the result is: **OEE** = (Good Count × Ideal Cycle Time) / Planned Production Time.
Alternatively, and often easier, OEE is calculated by dividing the minimum time needed to produce the parts under optimal conditions by the actual time needed to produce the parts.
For example:
 Total Time: 8-hour shift or 28,800 seconds, producing 14,400 parts, or one part every 2 seconds.
 Fastest possible cycle time is 1.5 seconds, hence only 21,600 seconds would have been needed to produce the 14,400 parts. The remaining 7,200 seconds or 2 hours were lost.
 The OEE is now the 21,600 seconds divided by 28,800 seconds (same as minimal 1.5 seconds per part divided by 2 actual seconds per part), or 75%.

1.5 5S

The 5-S practice is a technique used to establish and maintain quality and safe environment in an organization as shown in fig: 1.3
5S was developed in Japan and was identified as one of the techniques that enabled JUST IN TIME manufacturing. The 5-S is implemented by considering the basic 5 Japanese words i.e.
(1) Seiri -Sort
(2) Sieton -Set

(3) Seiso -Shine
(4) Sieketsu -Standardize
(5) Shitsuke -Sustain

Eliminating the waste from production processes is the major step for achieving success during 5S implementation. A 5S map is a plan that provides an overview of the processes happening in the workstation.

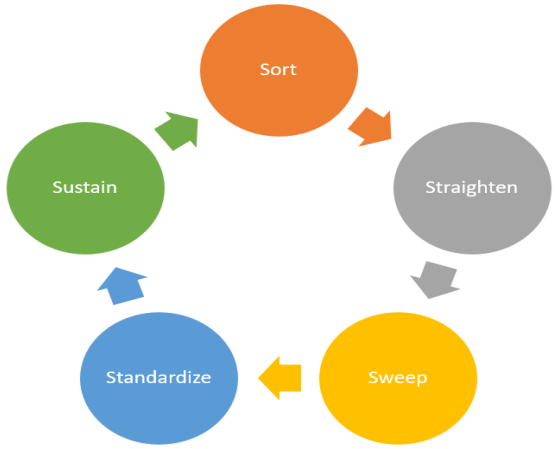

Fig 1.3 5S

2 OBJECTIVES:

(1). To eliminate non –value added process.
(2). To bring down processing time and total production duration.
(3). To create vsm, and to implement 5s.

2.1 FORMULATING THE PROBLEM:

The project begins with understanding the need for lean implementation in the concerning industry and analysing its current satiation. To address problems concerning waste and no-value process by implementing VSM and for optimal functioning. Which helps us to decide the processing order, elimination of unnecessary steps that add non value, creating smooth flow while avoiding lag and buffer. To determine the different operations performed and the cycle time of each machine in the cell and to reduce the delay caused due to breakage and shut down of the machines which will stop the whole process into a complete halt unless there are more than one machine that carries out the same process just to level out the delay caused. To understand the importance of 5S and what we can achieve by implementing 5S on the industry floor.

3 METHODOLOGY:

- Selection of cell
- Process involved
- Recognising the problem
- Creating a VSM model
- Performing OEE
- Apply new improved parameters
- Performing OEE for new values
- Comparison between new and old results
- Implementing 5S
- Reviewing the project
- Measures to sustain and improve

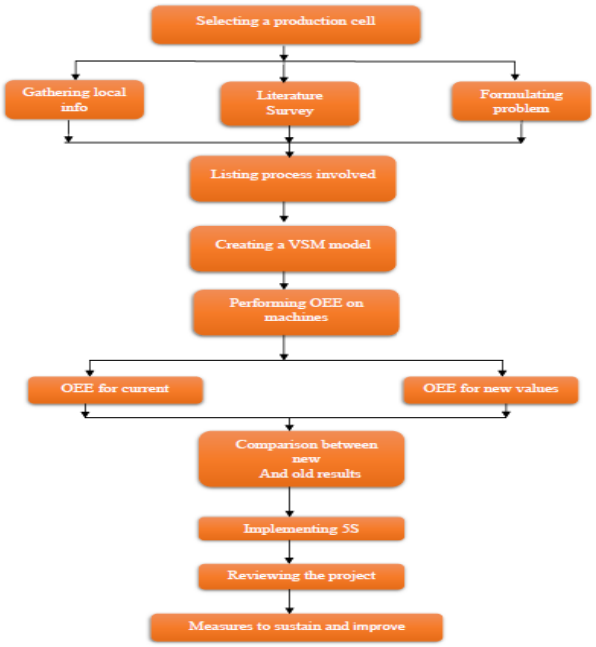

Fig 2

4. OPERATION PERFORMED:

SL NO	OPERATION NO	OPERATION NAME
1	OP05	Receiving inspection from the supplier
2	OP10	Surfacing
3	OP15	Receiving inspection from surfacing
4	OP20	TMC operations
5	OP30	Slitting operation
6	OP40	Manual deburring
7	OP50	Automatic deburring
8	OP65	Stage inspection before heat treatment
9	OP70	Heat treatment
10	OP75	Heat treatment inspection
11	OP80	Surface shining vibro
12	OP85	Vibro inspection
13	OP90	OD grinding stage 1 and 2
14	OP100	ID hard part turning

15	OP110	Buffing
16	OP115	100%-gauge inspection
17	OP125	Final inspection
18	OP130	Quality audit
19	OP140	Cleaning, packing and labeling

4.1 MACHINING OPERATIONS:

4.1.1 In-House operations:

 Operation 20:
TMC machining, this is the first machining process on the part in house. The process includes 2 setups. The machine used in this process is Mitsubishi machinery

 In setup 1:
OD finish 1.6 centre drill, 6mm ball rough, 6mm ball finish and 6mm chamfer.

 In setup 2:
OD turning, 9mm drill, 12mm end mill 5.1 drill, 5.1-hole mill, 6mm side chamfer and ID finish.
Most of these processes are automated while some are manual. The major portion of the part design is completed in this operation. The cycle time of this operation is 244 sec.

 Operation 30:
Slitting is a single operation; this operation created a slot type profile on the upper portion of the part. The process is handled by a single operator working on two machines with 2 parts at a time in a machine. The cycle time of this operation is 72 sec.

 Operation 40, 50:
Deburring is a cleaning operation that removes all the chips that are left hanging on the part edges. Deburring is a very fast and effective process. Its cycle time is 9sec. It accommodates both manual and automatic part handling.

 Operation 90:
OD grinding, after the part comes from the heat treatment and vibro machining the part undergoes precision operations to meet the customer specifications. The process includes clean surface finish on the outer surface of the part and maintaining tolerance.
This is done is two stages, the first stage follows the grinding operation and the second stage on the dimensions.

 Operation 100:
ID hart part turning, this operation includes turning operation on the inner diameter of the holes that are present on the top portion of the part. This process is also a precision process that concentrate on the finishing and dimensional parameters of the part.

 Operation 110:
Buffing, it an add-on operation that give the part a final shine as its appearance and also rubs off any foreign materials that might be stuck on the part surface. This process in the last machining operation that the part undergoes.

4.1.2 Out-house operations:

 Operation 10:
Surfacing, when the raw material arrives to the factory from the supplier. The part is bigger and rough. To the part is first put into surfacing operation that reduces the part thickness and gives it a relatively smooth surface. This process is done in Jigani plant.

 Operation 70:
Heat treatment, any component has to be heat treated to attain hardness, this part undergoes HT after the machining process. The HT is done batch wise with 1848 components per batch. The process takes almost a day to get completed.

 Operation 80:
Vibro machining, after the parts are heat treated there will be scales/residues on the part surface which has to be removed. Thus, the parts are put into vibro machine. The machine is a big cylindrical container with smooth pebbles that vibrate and rub against the part surface to remove the scales.

4.1.3 Packing operations:

 Operation 130:
Quality audit, after the part comes out of buffing. Every part is checked and sent to packing, but before the part is packed. A part is randomly picked and it is checked for all the parameters. Once the part is approved then the batch is moved on to packing. If not, then the whole batch is again inspected and possible corrections are made.

 Operation 140:
The final part of the operation is the packing, the part is cleaned with water and dipped in oil to avoid external damages, and the part is wrapped in bubble wrap and put in a box. The box is sealed, labelled and shipped to the customer.

4.2 INSPECTION OPERATION:

 Operation 05:
The first inspection done is on the raw material that comes to the factory from the supplier. The parts that come have different coded names depending on the batch of forge/casting and its forging/casting condition.

 Operation 15:
After the parts come from the surfacing, the parts are first checked for any physical damages that may occur during transportation and then the dimensions are checked, since

the whole lot of the part is sent for processing, selective inspection is implemented in this stage.

 Operation 65:
The part is machined, slatted and deburred before this inspection, this stage of inspection is where most of the rework and rejection comes. Since the machining process are fast there might be chipping and dimensional errors. This part of inspection notices all these errors.

 Operation 75 & 85:
The heat treatment is a very important part of manufacturing tiny component. This is where the part gets its hardness and strength. A batch of 1848 components are sent for heat treatment every time. Following heat treatment is the vibro machining. Vibro is a process of removing all the scales on a part that may have caused from the heat treatment and the to give the part a shining finish. In this stage the parts are checked for hardness and roughness of the surface.

 Operation115:
After the parts arrive to the factory from the heat treatment, they undergo some precision machining like outer diameter grinding, inner diameter turning and also buffing. At this stage of inspection, the part is almost ready for shipping. So, all the parts are checked for dimensions and smooth edges using air gauges and go & no-go gauges. This is called 100%-gauge inspection.

 Operation 125:
The final inspection includes visually inspecting each and every part that has been processed, if any visual flaws are found then the part is rejected. This is the final inspection the part undergoes before it is dispatched to the customer.

4.3 PART TRANSFORMATION (RAW MATERIAL TO FINISHED PRODUCTS):

4.3.1 Raw Material: The raw material is an alloy steel SAE 8620 whose chemical composition is C=0.20%, Mn=0.75%, Mo=0.2%, Cr=0.5%, Ni=0.55%. the raw material is acquired from a 3rd party source.

4.3.2 After Surfacing: Surfacing is the process which follows rough turning, produces a smooth surface finish, and cuts the work piece to an accurate size.

4.3.3 After Machining: In this process a cutting tool is used to remove small chips of material from the workpiece, this process produces the workpiece in the desired shape. A tmc machine is used to perform the required task.

4.3.4 After Deburring: Deburring is a process during which this unwanted material is removed with specialized tools. Machining operations employed include grinding, drilling, milling, engraving, and turning. These procedures may leave behind burrs (a rough edge or ridge left on an object by the action of a tool or machine).

4.3.5 After HT and V: In this process the metal is heated and cooled under tight controls to improve its properties, performance and durability.
vibro is also performed to produce the workpiece with good surface finishing after heat treatment.

4.3.6 OD and ID Finish: In this process the inner diameter and outer diameter is machined to produce a good surface finished workpiece for the given specification.

4.3.7 Buffing: In this step buffing is performed which refers to the use of a tool or machine to correct and shine the surface of a of the work piece.

5 VALUE STREAM MAPPING:
A value stream map was created using information acquired for each process in the manufacturing of Cam Carrier. The Value stream map includes the process involves all the value added machining process for which the customer is willing to pay, the process includes the steps starting from receiving the customer order until the finished product is shipped, which includes the operation OP10, OP20, OP30, OP40, OP40, OP70, OP80, and OP140. Achieving the target will require proper production planning and smooth flow of jobs in the production cell. Data concerning operation time, Quantity ordered, time taken to dispatch, cycle time, change over time, uptime, transportation time for intermediate process, and the 3rd party operation performed outside the plant. The Value Stream maps has been further divided into two parts:
(1) Value Added Process.
(2) Non-Value-Added Processes.
It is noted that various steps involved significant waiting time.

5.1 TERMINOLOGIES:
When adding process data, it is important to recognize what is useful for the given situation and purpose. In some cases, the purpose may not be entirely clear before the analysis is done, which leads us to add all the known data about the process.
The list below gives an overview of process data and abbreviations that may be of use for a VSM.
 Customer demand
 Cycle time (C/T)
 Process time (P/T)
 Changeover time (C/O)
 Number of operators (Op. or the symbol)
 Capacity (Cap.)
 Available time
 Uptime/downtime
 Quality or defects rate (Q)
 Number of product variations
 Batch size
 Inventory levels

5.2 VALUE STREAM MAPPING CHART:
In any production line there are always certain operations that need to be done, which the customer is not willing to

pay for, but those processes are very important for the factory to perform in order to maintain the quality of the product and also to maintain the competition in the market. These, during production of a component are the 2 kinds of operations, namely value-added process and non-value-added process. For clear recognition of these process, we come up with different techniques and one of them is Value stream mapping (VSM). Creating a VSM for an operation will give the production line all the information and processes involved.

5.2.1 Value Added Process:

All the major operations like drilling, facing, turning, etc. come under this category. Here, in this production line (SBD cam carrier) operations like TMC machining, slitting, heat treatment, surfacing and packing come under value added processes.

Firstly, as the component comes to the factory from the supplier, the components are checked for quality based on the forge code provided in the delivery sheet, according to that data the properties of the part is noted.

Them the part is sent to Jigani plant for surfacing and as and when it returns back the main TMC operation is started.

In TMC operation, there are 4 machines with two of them having auto feed system. This is followed by slitting operation and them deburring, the processed part is then checked and sent for further process.

Every forged component has to heat treated for hardening, hardening is crucial part on manufacturing a part, its life span and working conditions are majorly dependent on this.

Then after a part is heat treated, they are sent to vibro machining which remove all the black scales and gives the part a silver shine finish. Then the part is delivered to the plant for further finishing process.

Once the precision processes are completed, the part is cleaned, quality checked, packed, labelled and sealed. Ready for shipping to the customer.

Creating a VSM for a part machining needs calculation of many parameters like cycle time, change over time, machine availability, lead time and customer Takt.

Parameters like cycle time and change over time are taken during part programming and computer simulation of the part.

5.2.2 Non-Value-Added Process:

The non-value-added operations are the curtail part of manufacturing as they are the operations that bring up the hard work of the industry. The process like finishing, buffing, polishing, defect testing, dimension checking, are some of the process involved here. These are the operations that has to be done to satisfy the customer and earn their trust in giving future orders.

Though these processes take time to finish they are done in a lot, this not only gives a second chance for correction of mistakes are checking the defects but also, they make sure that the part is safely handled throughout the machining process and correct the mistakes that went wrong.

For this part, the operations performed are:

- outer diameter grinding
- inner diameter turning
- final buffing
- 100%-gauge inspection
- Quality audit
- Finally, packing and Dispatched

6 OVERALL EQUIPMENT EFFICIENCY/ EFFECTIVENESS: (OEE)

Manufacturing a product is a complex process. Without metrics and guidelines, it is very easy to lose control and have your business managed by your production. OEE is a tool that combines multiple manufacturing issues and data points to provide information about the process. By analysing and calculating data it also functions as a framework for root cause analysis. Through a documented process of combining the underlying data OEE provides specific process information. All members of the manufacturing team, from assembly technicians to financial personnel can use the data to understand the current state of the manufacturing process. By having a predetermined framework of the impact of machine availability, performance and quality, OEE provides a framework to track underlying issues and root causes. OEE also provides a framework for improvements in the manufacturing process. By using key OEE concepts such as The Six Big Losses waste exposed by tracking OEE can be understood and efficiencies can be improved.

The components of this framework are:

- OEE
- Availability
- Performance
- Quality

6.1 EQIPMENT USED TO PERFORM OPERATION 20: TMC

The TMC machine used are the most robust machines designed for heavy and interrupted cutting thereby letting you to achieve superior finishing and long-term accuracies in conjunction with ease of service, excellent maintainability and flexibility. This machine is used for machining large diameter components used in automobile industries.

The machine is designed in such a way that its rigid structure and robust build quality helps in high speed & heavy-duty process forces. The Bed & Saddle made from higher grade cast iron provides maximum rigidity, Thermal stability, damping & least distortion which makes it most suitable for hard part turning.

6.2 CALCULATION OF OEE FOR EACH MACHINE AND FOR EACH SHIFT:

Factors that provides the basis for calculation of OEE are,

- **MACHINE NO**-The machine on which the processing has been carried out.

- **EMPLOYEE NO**-The worker who has done the job on the machine.

 SHIFT NO- The shift in which the process is carried out.

 OPERATION-The procedure happening on the work piece like drilling, chamfering etc.

 CYCLE TIME-The time required to finish the processing of a single work piece in seconds.

 OK PROCESSED- The no of work pieces that has been processed over a shift.

 FIRST TIME RIGHT (FTR) - The no of work pieces that has been processed with no defects in the very first process cycle.

 REWORK-The no of work pieces that has to be reprocessed after its first process cycle due to some defects.

 SCRAP- The no of work pieces that has to be put out because the defects caused in them are irreversible.

 OPERATION TIME- The total time allotted for running the machine over a day.

 RUN TIME- The actual time the machine runs throughout the day.
Now we have to consider the parameters that depends on other values that provides certain results that signifies the importance of OEE in manufacturing.

 QUALITY RATE- It is the ratio of FTR to that of the OK Processed.

OEE provides an accurate picture of the manufacturing processes efficiency and it helps to make improvements in any section of the manufacturing process.
OEE doesn't provide much information on productivity losses. This is analysed in a detailed manner using the data parameters like machine availability, quality and performance.

7 5S

The 5-S practice is a technique used to establish and maintain quality and safe environment in an organization. The concept of 5S was developed in Japan and was identified as one of the techniques that enabled JUST IN TIME manufacturing.
The 5-S is implemented by considering the basic 5 Japanese words,
(1) Seiri-Sort
(2) Sieton-Set
(3) Seiso-Shine
(4) Sieketsu-Standardize
(5) Shitsuke-Sustain

Eliminating the waste from production processes is the major step for achieving success during 5S implementation. A 5S map is a plan that provides an overview of the processes happening in the workstation.

Benefits of 5-S

 Reduced Costs
 Higher Quality
 Increased Productivity
 Greater employee satisfaction
 A safer working environment

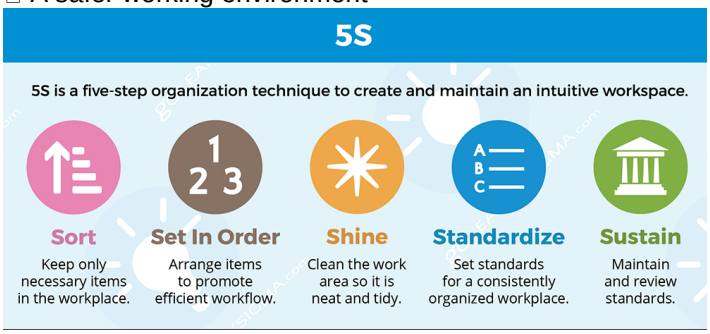

Fig: 7.1 5S

The idea of implementing 5S at Maini precisions was first suggested to us by Mr. Balaji S. in addition to the lean manufacturing. First, we had the plan prepared on how to approach the workers so as to not disturb the production line. So primarily after we had the permission take by the production manager and the line manager, we called in all the workers of that line to a meeting. There we explained them what we are implementing and what is the role they play in implementing 5S and how it will benefit them. Of course, we had to face few questions that we had no answers but we were backed by our guide Mr. Balaji to tackle them.
After a complete briefing of the procedure to the employees, we began the process.

7.1 1S-SORTING

The first step of 5S "Sort" involves going through all the tools, materials, equipment, etc. in a work area to determine what needs to be present and what can be removed
It involved:
1. Undertaking major cleaning activities.
2. Waste elimination was given the highest priority.
3. Disposal of unwanted things and upkeep of necessary and important things.
4. Segregated storage methods depending on the priority.

7.2 2S - SET

Setting is putting all necessary items in the optimal place for fulfilling their function in the workplace to make the workflow smooth and easy.
This included:
1. Ensure rational layout of machines, equipment and cabinets.
2. Place frequently used items at the point of use based on urgency.
3. Pre-fix a place for everything and put everything in its place with pre-determined quantity.
4. Identify useful items with labels, colour codes and location etc.

7.3 3S - SHINE

The Shine stage of 5S focuses on cleaning up the work area, which means sweeping, mopping, dusting, wiping down surfaces, putting tools and materials away, etc.
Steps that followed shine are:

1. Identify which parts are to be cleaned for each shift, daily, weekly, monthly etc.
2. Plan for systematic daily/periodic cleaning of all nooks and corners of the zone (the selected cell).
3. Ensure cleaning material and cleaning tools are available at an accessible place.

7.4 4S - STANDARDIZE

Seiketsu is to standardize the processes used to sort, order and clean the workplace and to establish procedures and schedules to ensure the repetition of the first three 'S' practices.
Steps to be followed for standardization
1. Develop a work structure that will support the new practices and make it part of the daily routine.
2. Ensure everyone knows their responsibilities of performing the sorting, organizing and cleaning.
3. Use photos and visual controls to help keep everything as it should be.
4. Review the status of 5S implementation regularly using audit checklists.

7.5 5S-SUSTAIN

Shinseki or sustain the developed processes by self-discipline of the workers and ensure that the 5S approach is followed.
Steps to be followed for sustaining:
1. Organize training sessions.
2. Perform regular audits to ensure that all defined standards are being implemented and followed.
3. Implement improvements whenever possible. Worker inputs can be very valuable for identifying improvements.
4. When issues arise, identify their cause and implement the changes necessary to avoid recurrence.

8.3 SUGGESTION:

8.3.1 Reducing the tool overhang for 4 operations in TMC machining operation:

Reducing the overhang of the tool is a very ideal suggesting. The important reason for reducing the tool overhang is not only to increase the tool life but it also allows us to increase the cutting speed significantly. The graph gives you a clear picture of how reducing the tool overhang will affect the machining process and part finish.

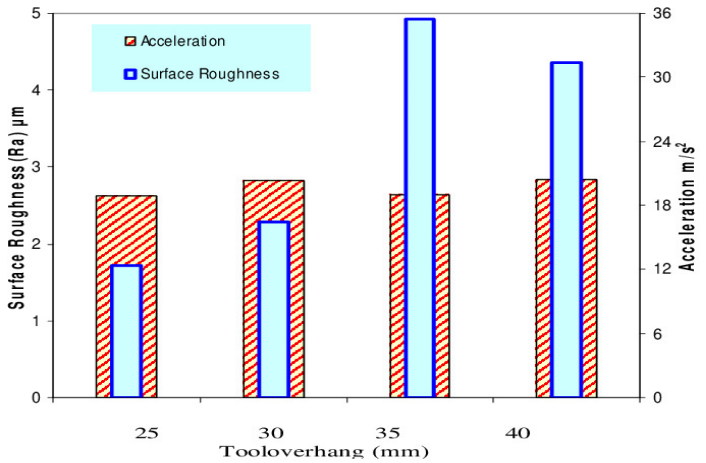

Fig.8.1 Tool Overhanging V/S Surface Roughness and Acc

We also mentioned that the life of the tool also increases when the overhang is reduced with respect to deflection. The graph below gives you an idea of how they are related.

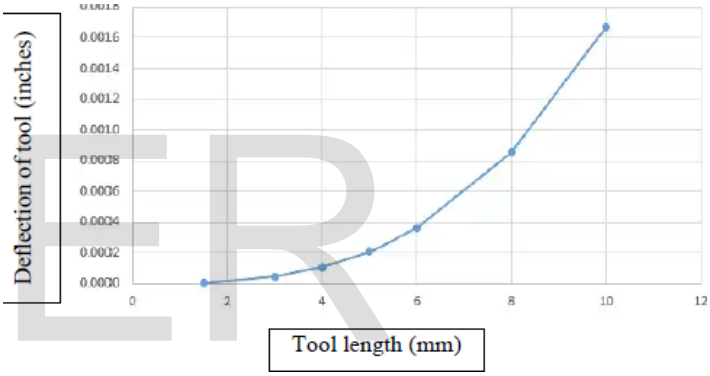

Fig.8.2 Tool Length V/S Deflection

Here we are suggesting the company 4 process in which this can be applied:
a. OD finish in setup 1

b. OD turning in setup 2

c. ID finish in setup 2

d. 5.1 drill in setup 2

The current tool length is about 70mm including the shank, the idea is to reduce it to almost 40mm which can help us run the spindle at 3500-4000 rpm instead of 2500 rpm. This also increases the surface finish of the part.

8.3.2 Using a combined tool in machining setup 1 and 2:

When there are many operations to be performed on a part, there are a lot of tools that has to be used and tool management becomes crucial. Soto reduce the total cycle time, using combined tool is a better option. One thing to be noted here is that even though the tool cost is high, the overall cost for the part manufacturing reduces.
Here we are suggesting them two combined tools:
a. Using a combined ball end mill with chamfer.

b. Using a combined drill-tap tool.

Using these tools, the machining time for non-value-added process are reduced increasing the machine OEE and also reducing the cycle time. The tools are structurally strong and can run at higher speed for more than 1000 parts. This reduces the part manufacturing cost leading to profitable outcome.

8.3.3 Using tools with screw insert:

When a tool fails it has to be replaced, the process is east but it takes time. The fixture has to be loosened then the tool holder has to be pulled out, and then the tool has to be replaced and the fixing process follows in the reverse order.

There is an easier way which is effective and reduces the tool changing time. It is by using a screw type insert which can easily be replaced. It's similar to screwing and loosening a screw. They are shorter in length and have wide body which make them structurally strong.

8.1 CONCLUSIONS:

This report presented is a significant insight into the current status of lean manufacturing implementation in Indian machine tool industries, as well as tinted some allied issues. Firstly, the work has attempted to formulate a simple questionnaire-based tool to identify the existing level of lean practices, reasons for inadequate priority.

To lean concepts, type of lean tools employed, perceived level of different wastes, and

The common difficulties encountered by the Indian machine manufacturers. Therefore, the machine manufacturing companies got to give attention to implement lean altogether the key areas from a holistic perspective. Appropriate lean education and research set up in association with industries has to be fostered and encouraged to stimulate the lean awareness and higher technological standards in manufacturing. The role of lean thinking is immense towards achieving this objective.

One of the most rewarding aspects of VSM is to see how this tool allows taking a snapshot of the current situation, and identify waste and eliminate it from the value stream. VSM may be a powerful tool that brings relevancy, a touch complicated and time consuming, but worthwhile. It can be implemented in any field to detect wasteful activities. It helps us in understanding how each process affects the next one, and how it interrupts the flow of work.

Based on our VSM model we can conclude that value added mapping helps in understanding the work processes using the tools and techniques of lean manufacturing. The goal of non-value-added mapping is to identify, demonstrate and decrease the amount of waste in the process. In our observation, the cycle time for operation 20 running on the turn mill centre is quite more, so machine simulation shows where the bottleneck appears in a production based on cycle time. A bottleneck is something that limits the capacity of a system. It can be cut down by the given suggestion**.**

Overall equipment efficiency is a common measure of performance to indicate the utilization of machine to its full potential. The benefit of OEE is that it establishes benchmarks for success, it divides improvement opportunities into measurable categories, and it provides a measuring mechanism that allows for production improvement. There is no end goal; according to the factors affecting the production it is impossible to achieve 100%. However, the runway exists to raise goals for as long as your OEE process is in place. Ultimately, the OEE measurement mechanism encourages action. According to the production details calculated, there is very high chance of increasing the efficiency of the equipment as there are work piece subjected to rework.

5S implementation is very easy because no difficult technologies are present. They are logical, simple and natural to human behaviour. 5S should not be considered as a house keeping exercise. For achieving potential benefits from it one should develop a habit of not blaming people. 5S implementation cannot be achieved if we are forcing people to work harder and faster. In order to make successful 5S system most important factors are participation, commitment and support from top level management. By implementing first 'S' first change seen will be unwanted items are eliminated and searching time is reduced. Thereby there is improved working environment and space utilised is maximised. Implementing 2nd 'S' results in easy storage and retrieval of the items. There is a place for everything which prevents misplacing. 3rd 'S' helps in having a clean, safer environment and making good impression on the visitors. Implementing 4th 'S' will ensure better workplace standards and visual control systems. Development of team spirit and discipline can achieve by implementing 5th 'S'.

8.2 FUTURE SCOPE:

VSM:

Business is growing more competitive every day. In order to keep up with customer demand and expectations, development teams are having to work faster and be more efficient than ever before. However, it's not just the development teams that are impacted by these increased demands. A VSM activity can help to identify and better coordinate other impacted operational teams and process segments that are integral to the overall development process.

As the value stream mapping activity engages the team members, one of the key benefits that will be realized is that it provides an element of understanding to the voice of the customer. It helps identify what it is that the customer is asking for, what they value, what they need and how to best achieve exactly that in the most efficient means possible. Understanding quality from the customer's perspective can be invaluable to the performance of the process and quality of the product.

OEE:

Under current economic conditions, severe global competition and postponement of new equipment purchases are causing business executives to be sensitive about all aspects of manufacturing operational costs. In this environment, it pays to consider both creative and proven methods

that manufacturers can use to bring their product to market at minimum cost. "Overall Equipment Effectiveness" (OEE) is a method that meets this objective.

An OEE solution can enable manufacturers to achieve world-class status. More specifically, it can provide benefits in three key areas:

1. **Equipment:** Reduced equipment downtime and maintenance costs, plus better management of the equipment life cycle
2. **Personnel:** Labour efficiencies and increased productivity by improving visibility into operations and empowering operators
3. **Process:** Increased productivity by identifying bottlenecks

4. **Quality:** Increased rate of quality, reduced scrap

The need for OEE is indicated by the Industry Week 2001 census of Key Performance Metrics for manufacturing. The survey shows that the top 4% of world-class manufacturers benefit from a low 2% (median value) of unscheduled machine downtime.1 this means that the remaining 96% percent have an opportunity to improve performance by reducing unscheduled downtime. Downtime reductions can be readily achieved by using OEE to gain visibility into machine status and to perform root-cause analysis of problems. Fundamentally, OEE is a performance metric compiled from data on Machine Availability, Performance Efficiency and Rate of Quality that is collected either manually or automatically.

5S:

The scope of this work is limited to determine performance factors and dimensions of industrial organizations and also characteristics of those dimensions, which will be proposed as questions, and finally find out whether 5S is an effective method to improve whole performance of an industrial organization. It realized that the scope is ambitious in that, but it examines a new outlook at organization and total quality approach, however it is limited enough to be a realistic base for a research. The output of this research will help us to locate 5S practices in the most suitable framework for total quality management and performance improvement in industrial organizations.

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