International Journal of Scientific Engineering and Research (IJSER)
www.ijser.in
ISSN (Online): 2347-3878, Impact Factor (2014): 3.05

A Case Study on Improving Process and Eliminating Waste through Lean Manufacturing Techniques

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Abstract: ***The concept of moving assembly line was reached through immense efforts & cognitive abilities of Henry Ford in 1913 at Highland Park, Michigan which became a base for flow production. It was a basic model & thus suffered from inability to provide variations in manufacturing line which is prime focus of any developing industry. As change is a vital part of life, around 1930's Kiichiro Toyoda & his team worked to ameliorate this concept through a series of simple innovations which overcame the shortcomings of Ford's theory by providing wide variety in product along with process flow improvement. We were influenced by this concept which drive up to get this concept implicated into an industry suffering from this kind of problems. In this research paper we have explained the concept of lean manufacturing along with NVA's and showed its implication in industry to improve their laggings and proposed them to improve their production processes.***

Keywords: Lean, NVAA, Waste, Process, Elimination

1. Introduction

1.1 Lean Manufacturing

Lean manufacturing is a methodical approach to identify and abolish waste of all Non Value Added elements through continuous improvement that has been adopted by industries or firms seeking for efficient manufacturing. Lean manufacturing consists of word lean which means to reduce or to minimize the waste in production which leads to maximum utilization of resources and ends up with increased value of product.

1.2 Objective of Lean Manufacturing

- Reduce waste.
- Increase productivity.
- Motivate innovative practices for overall improvement of operation.
- Encourage continuous improvement.

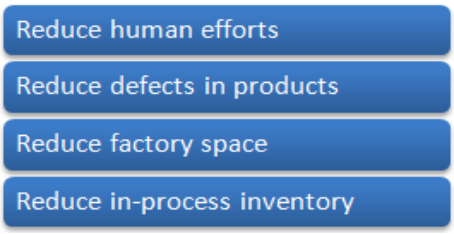

Figure 1: Lean manufacturing outcomes

2. Seven Wastes

2.1. Overproduction

Overproduction waste occurs due to increased rate of production than actually required, this over production leads to over handling of finished product which finally causes to increase undesirable inventory space as well as expenses. The factors leading to this type of waste are:

- Poor production planning
- Poor scheduling
- Poor machine run time estimation

2.2. Transportation

Transportation waste occurs due to moving of product with in the plant between different manufacturing processes, this waste result in additional expenses in commuting product, decrease in efficiency of manufacturing, non-value added labor exertion and sometimes can cause damage or product deterioration. The factors leading to this type of waste are:

- Inadequate plant layout
- Poor product handing over methods
- Poorly managed space in plant
- Imbalanced material flow

2.3. Waiting

Waiting waste occurs due to the waiting of one work station for another work station to complete the job and hand it over further, this waste generally occurs where synchronization between two work station is poor and finally results into man or machines idle or waste of time. This waste can be reduced by proper balancing and synchronization of processes in plant, minimizing overproduction and transportation waste and standardization of processes

2.4. Motion

Motion waste occurs due to unwanted motion of labors in a plant, these motions which are walking, bending, lifting and etcetera are of no use at all and considered as waste. Observation has shown that only 5% of these motions are useful. These unwanted motions are usually in search of tools

or documents required. The factors leading to this type of waste are:

- Disorganization of tools
- Non-standardized process instructions
- Poor layout of plant
- Poor workplace ergonomic

2.5. Defects

Defects waste occurs due to production of a product not according to the customers demand or required specification and the product is considered to be a waste which further increases the cost of product. To minimize the defects waste clear required specification and precise production techniques should be used as well a quality control or inspection could be introduced in the process but this would eventually increase the final cost of the product. The factors leading to this type of waste are:

- Ambiguous processes and specifications
- Lack of skills in workers
- Operational errors

2.6. Processing

Processing waste occurs due to excessive complications in the processes, working on the product than actually needed with unnecessary tight tolerance, this would finally increase the time required in process as well as cost associated with it and this extra work will b considered as waste. The work should be to the level required no more no less. The factors leading to this type of waste are:

- Non-standardized process instructions
- Ambiguous about the acceptance of level of quality

2.7. Inventory

Inventory waste occurs due to stock of raw material or products yet to be finished or on-hold finished products to be supplied to the customers, these stocks increases an additional cost in terms of its storage and maintenance. This waste can be minimized by reduction in unnecessary accumulation of inventory in a continuous process, as well by applying just in time to it. The factors leading to this type of waste are:

- Avoidable inventory built between different process
- Improper flow of material
- Incapable of predicting market requirement

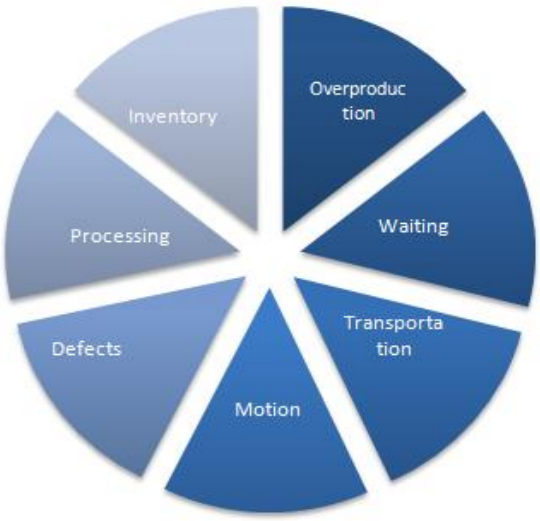

Figure 2: Seven wastes

3. Process of Lean Manufacturing

Process of lean manufacturing is the method of applying all inclusive sets of techniques which will allow us to reduce and eliminate waste, which will subsequently makes your process leaner and efficient.

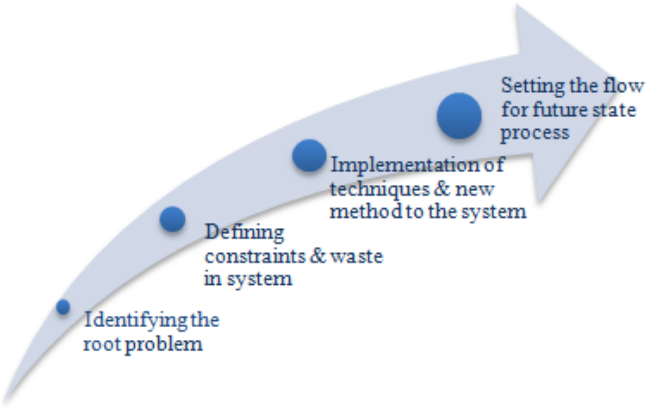

Figure 3: Steps involved in Lean manufacturing.

3.1. Lean manufacturing's techniques and tools

Lean manufacturing is based on determining all the flaws in the system and rectifying it by using appropriate tools and techniques, these tools and techniques helps us to optimize the process by saving time, reducing waste, improving quality and controlling inventory overflow.

3.1.1. Total Quality Management (TQM)

TQM is both philosophy and set of techniques that represents the corner stone of continues improving an organization or a system. It consists of human resources and significant methods to improve the material and services supplied to a system.

3.1.2. Poka-Yoke

It is a technique invented by Shigeo Shingo in 1960. The word POKA means accidental mistakes and YOKE means to prevent these mistakes. It is essentially framed so that the mistakes are nearly impossible. The basic objective of

POKA-YOKE is reducing the defects by practicing it more and more into any system.

3.1.3. Kaizen

Kaizen consists of two words "KAI" which means change and "ZEN" which is good, so all in all kaizen stands for change for good. It effects in contentious change which ends up with continuous improvement. It implies for coordination between various functions in the production system. No considerable investment id required and the results could be seen within no time of implication.

3.1.4. APQP

APQP stands for Advanced Product Quality Planning which aims at providing best quality product to the customer; ensure timely completion of required goals &achieving 100% customer satisfaction. It consists of five phases & five major activities along with ongoing feedback assessment & corrective action. Thus it is a systematic approach to enhance quality & increase production rate thereby increasing the profit; thus applied by many companies.

Five phases are as follows:

- Plan & Define Program
- Product Design & Development Verification
- Process Design & Development Verification
- Product & Process Validation
- Corrective action plan and customer feedback assessment

3.1.5. FMEA

It stands for Failure Mode& Effects Analysis& is a powerful tool in analyzing postulated component failures & evaluating its effects on system operation. Main aim is to calculate RPN (Risk Priority Number) & if it crosses value predefined necessary actions are to be needed to rectify the failure mode.

RPN= Severity rating X Occurrence rating X Detection rating

There is a standard guidelines made by AIAG- Automotive Industry Action Group for each severity, occurrence & detection rating. Use the standard guidelines to determine RPN. By using this technique you eliminate failure modes & thus improve your production rate & line stoppages are reduced to a great extent.

3.1.6. JIT

It stands for Just in Time manufacturing production & is aimed primarily at reducing flow time within production& also to speed up responses from suppliers & to customers. Thus it results in completion of goals within time. An inventory strategy companies employ this strategy to increase efficiency &reducing wastes thereby resulting in reducing inventory costs.

3.1.7. Five S

It uses a list of five Japanese words all beginning with letter S namely: seiri (sort), seiton (straighten), seiso (shine), seiketsu (standardize) & shitsuke (sustain). *Though other translations are possible.

The focus of this approach is to systematically organize a work station for efficiently & effectiveness of all the line processes involved in the process by identifying the items used with proper tagging to make them easy to recognize & storing the items used in proper atmosphere so that the quality of raw materials doesn't deteriorate. There is a built up standard dialogue which guides the employees that how they should do the work.

3.2. NVA (Non Value Added) Activities

These are the activities which contribute in increasing time spent on a product or a service without contributing much in enhancing worth of products or service significantly to a customer. By eliminating such activities we can have a drastic time as well as cost reduction in the manufacturing processes.

4. Case Study

As per the study carried out in a company XYZ (Secrecy), which manufactures miscellaneous items for other industries. Different discrepancies were observed at production line which needed suitable rectification. Here are different parameters which were looked upon during our research & illustrated below.

4.1. Pant layout

The amount of space available is immense but not well utilized, better layout design must be made for maximum utilization of work space to improve working condition &ambience which is one of the major factors to get high output from the workers.

4.2. Process Improvement

Due to dependency of one work station over other results in increasing cycle time as well as formation of bottlenecks that hinders the production rate. By using line balancing technique & WIP (Work in Progress) cycle time can be reduced substantially which thereby increases production rate.

4.3. Inventory management

Excess flow of material into industry causes increase in labor as well as maintenance cost. To improve the flow of material according to the need techniques such as ABC (Always Better Control) analysis, forecasting method, Kaizen, JIT is proposed.

4.4. Productivity & Quality Management

For any company ultimate goal is customer satisfaction which is achieved by providing best quality material along with meeting customer needs timely. To balance both productivity & quality techniques such as TQM, Five S, APQP is proposed.

Following is the NVA reduction plan for various operations performed over different stations.

Table 1: NVAA Reduction Plan

S. No	Station Name	NVAA	Approx. time(sec.)	Suggestion to overcome issue
1	Harness Sub-Assembly	Open the wiring harness & throw the polybag into dustbin.	50	Polybags over wiring harness should be avoided. To prevent them from being damaged, bulk packing design should be improved.
		Bring different auxiliary wiring harness from different racks according to vehicles specification.	200	Pre-specified sets of different auxiliary wiring harness should be prepared prior to the operation to reduce human efforts & substantially increase the production rate.
		Bring different fuse from the rack & insert it into fused box using soft hammer.	585	Fuse should be inserted into fuse box prior to operation to minimize time & get a seamless production.
2	Steering Sub-Assembly	Bending of body to mount ring assy. over compression spring & tightening the socket.	57	A self- locking socket should be introduced to reduce human efforts.
		Apply LC2 grease to steering tube by hand brush.	10	Introduction of grease gun to maintain clean work station along with reducing time.
		Change power gun tool to fix steering column nut.	34	Provide separate power gun to eliminate time of changing tool.
3	Pedal Sub-Assembly	Assy. of clutch master cylinder.	302	Asking for complete master cylinder from vendor.
		Mounting rubber pad over pedal using screw driver.	35	Proper procedure for installing to reduce accidents due to improper use of screw driver.

5. Conclusions

It is an adage that "Slow & steady wins the race", it is absolutely true for working culture of an organization. Lean Manufacturing is a very effective & widely accepted technique for continuous small improvements in an organization rather than rapid & bigger improvement. To sustain in this competitive world organization depends upon such techniques mentioned above to fulfill customer demands as well as gaining their trust. Here in the research paper we have analyzed different parameters that were hindering the organization in achieving its ultimate goals & through case study we have tried to eliminate the hindrance & achieved organization goal to a great extent.

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