iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 4 **Issue:** XI **Month of publication:** November 2016

DOI:

www.ijraset.com

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)

A Review on Manufacturing Cycle Time Reduction by Applying Lean Tools and Technique in Small Scale Industries

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Abstract:-Cycle time should be painstaking a viable option when an organization is demanding to perk up efficiency, productivity and cost base and customer reaction. Tools of lean manufacturing are used to diminish to the cycle time in small scale industries, which contains many non-value added activities and work. This paper deals with studying of lean manufacturing definition, principles, waste and its tools for diminish the cycle time reduction.
Keywords:-lean manufacturing, lean waste, lean tools and techniques.

I. INTRODUCTION

Due to globalization and conjugal business scenario Indian industries have faced many challenges to battle in the global market. Success in competitive markets more and more demands ever shorter product and service introduction cycles and more rapid response to customers. Reduction in cycle time and rapid response to customers can occur when work processes are designed to meet both quality and response goals. Industries require step up in Production Lead Times, costs and customer service levels to stay alive global market. They have initiated a lot of strategies such as TQM, SQC, Six Sigma, but these approaches did not optimize the time for the manufacturing these products given by lean manufacturing.

Enlargement of an industry and its productivity eventually depends on its knack to systematically and continuously respond to the market changes for enhancing the product value. Manufacturers have to appreciate that the conventional production system has to hook up with the lean tools and techniques.

II. LEAN MANUFACTURING HISTORY AND DEFINITION:-

A. History

During II world war, the economic condition of Japan was heavily ruined. Due to this there was scarcity of endowment resulting in off-putting access to corporate finance. In this situation, neither Toyota was able to set up a mass production system like their American counterparts, nor it was possible to layoff the employees to reduce their cost due to legislation. Anyhow Toyota had to devise a new system for reducing costs to sustain in the market. So they unfaltering to produce a small batch of products which would cut inventories; it means they would need a smaller amount capital to produce the same product. But this is stymied by the realistic impenetrability of changing tools and production lines frequently. To cope with this problem they started making flexible tooling systems in their machines and educated their employees in changeover time reduction methods. At the same time, Toyota realized that investing in people is more important than investing in superior size machinery and continues employee training throughout the organization. This motivates all employees and they are more open to the upgrading process and everyone started giving their input to the company.

In this way, short production runs started by Toyota became a benefit rather than a burden, as it was able to retort much more hurriedly to changes in demand by quickly switching production from one model to another (Drew, Blair and Stefan, 2004, p. 5-6). Toyota didn't depend on the economies of scale production like American companies. It rather developed a culture, organization and operating system that relentlessly pursued the elimination of waste, variability and inflexibility. To achieve this, it focused its operating system on responding to demand and nothing else. This in turn means it has to be flexible; when there are changes in demand, the operating system is a secure workforce that is vital to be much more skilled and much more flexible than those in most mass production systems. Over time, all these elements were consolidate into a new approach to operations that fashioned the basis of lean or Toyota Production System.

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B. Definition

It is a widespread set of techniques which when pooled allows you to reduce and eliminate the wastes. This will make the company leaner, more flexible and more responsive by reducing waste.

Lean is the systematic approach to identifying and eliminating waste through continuous improvement by flowing the product or service at the pull of your customer in pursuit of perfection.

III. LEAN PRINCIPLES

A. Accurately specify value from customer perspective for both products and services.
B. Identify the value stream for products and services and remove non-value adding waste along the value stream.
C. Make the product and services flow without interruption across the value stream.
D. Authorize production of products and services based on the pull by the customer.
E. Strive for perfection by constantly removing layers of waste.

IV. KIND OF WASTES

Different kinds of wastes in a process can be categorized in following categories. These wastes reduce production efficiency, quality of work as well as increase production lead time.

A. Overproduction

Producing items more than required at given point of time i.e. producing items without actual orders creating the surplus of inventories which needs excess staffs, storage area as well as transportation etc.

B. Waiting

Workers waiting for raw material, the machine or information etc. is known as waiting and is the waste of productive time. The waiting can occur in various ways for example; due to unmatched worker/machine performance, machine breakdowns, lack of work knowledge, stock outs etc.

C. Unnecessary Transport

Hauling of work in process (WIP) a long distance, insufficient transport, moving material from one place to another place is known as the unnecessary transport.

D. Over processing

Working on a product more than the actual requirements are termed as over processing. The over processing may be due to improper tools or improper procedures etc. The over processing is the waste of time and machines which does not add any value to the final product.

E. Excess Raw Material

This includes excess raw material, WIP, or finished goods causing longer lead times, obsolescence, damaged goods, transportation and storage costs, and delay. Also, the extra inventory hides problems such as production imbalances, late deliveries from suppliers, defects, equipment downtime, and long setup times.

F. Unnecessary Movement

Any wasted motion that the workers have to perform during their work is termed as unnecessary movement. For example movement during searching for tools, shifting WIP etc.

G. Defects

Defects in the processed parts is termed as waste. Repairing defective parts or producing defective parts or replacing the parts due to poor quality etc. is the waste of time and effort.

H. Unused Employee Creativity

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Loosing of getting better ideas, improvement, skills and learning opportunities by avoiding the presence of employee is termed as unused employee creativity.

V. LEAN TOOLS AND TECHNIQUES

A. *Value steam mapping*

Value Stream Mapping was originally developed as a method within the Toyota Production System and introduced as a distinct methodology by Rother & Shook . Value Stream Mapping is a simple, yet very effective, method to gain a holistic overview of the conditions of the value streams within an organization. Based on the analysis of the current-condition, flow-oriented target value streams (target-conditions) are planned and implemented. A value stream includes all activities, i.e. value adding, non-value adding and supporting activities that are necessary to create a product (or to render a service) and to make it available to the customer.

B. *Standard work*

Standardized work is a tool for maintaining productivity, quality, and safety, at high levels. It is defined as work in which the sequence of job elements has been efficiently organized, and is repeatedly followed by a team member. It is a process whose goal is kaizen. If standardized work doesn't change, we are regressing.

C. *Mistake proofing poka-yoke*

Mistake-proofing is very easy to understand, it is grounded in common sense. Its essence is to design both the product and the processes so that mistakes are either impossible to make or, at the least, they are easy to detect and correct. At the heart of mistake-proofing is simply paying careful attention to every activity in the process and then placing appropriate checks and problem prevention facilitators at each step in the process.

Mistake proofing is three simple steps:

1) Identify possible errors that might still occur in spite of preventive actions.
2) Determine a way to detect that an error or malfunction either is taking place, or is about to take place.
3) Identify and select the specific action to be taken when an error is detected.

D. *Point of use storage*

Stock-keeping units those are stored at the location where they will be used. This type of inventory management is often found in manufacturing or production assembly lines. This is a lean manufacturing practice that tends to minimize the amount of inventory kept on hand since available space is typically limited at the point of use.

E. *5s visual management*

5S is a technique originated from Japan and it was first developed by Hiroyuki Hirano. It include five words Seiri, Seiton, Seiso, Seiketsu and Shitsuke, which means Sort, Set in order, Shine, Standardize and Sustain respectively. The 5S technique is included within „Kaizen" which means „change for the better". It allows the enhancement of efficiency and productivity. The 5S technique is a structured program to systematically achieve total organization cleanliness, and standardization in the workplace. The benefit of 5S technique is improvement in productivity, quality, health and safety. Term of 5S given as: SEIR(sort): the removal of all unwanted, unnecessary, and unrelated materials in the workplace.

F. *One piece flow production*

One-piece flow describes the sequence of product or of transactional activities through a process one unit at a time. In contrast, batch processing creates a large number of products or works on a large number of transactions at one time – sending them together as a group through each operational step. In one-piece flow, focus is on the product or on the transactional process, rather than on the waiting, transporting, and storage of either. One-piece flow methods need short changeover times and are conducive to a pull system.

G. *TPM equipment reliability*

The concept of Total Productive Maintenance (TPM) has been introduced and developed by Japanese in 1971. This came in response to the maintenance and support problems in commercial factory. It is team-based preventive and productive maintenance and involves every level, from top executive to the floor operator. TPM has been proven to be successful for helping to increase the

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productivity and overall equipment effectiveness. TPM can be defined as a program for fundamental improvement of the maintenance functions in an organization, which involves its entire human resources. TPM philosophy requires the development of a preventative maintenance program for the life-cycle of the equipment and the involvement of operators in maintaining the equipment in order to maximize its overall efficiency and effectiveness.

H. Level mix production

Mixed Model Production is the practice of assembling several distinct models of a product on the same assembly line without changeovers and then sequencing those models in a way that smoothes the demand for upstream components. The objective is to smooth demand on upstream work centers or suppliers and thereby reduce inventory, eliminate changeovers, improve kanban operation. It also eliminates difficult assembly line changeovers.

I. Kanban demand pull

Kanban is the Japanese word for “card”. Pull / Kanban is a method of controlling the flow of production through the factory based on a customer’s demand. Pull systems control the flow of resources in a production process by replacing only what has been consumed. They are customer order-driven production schedules based on actual demand and consumption rather than forecasting. Implementing pull systems can help you eliminate waste in handling, storing, and getting your product to the customer. Pull systems are an excellent tool to use in the areas where cellular or flow manufacturing can not be achieved.

J. SMED-quick changeover

Single Minute Exchange of Die (SMED) is one of the many lean production methods for reducing waste in a manufacturing process. It provides a rapid and efficient way of converting a manufacturing process from running the current product to running the next product. This rapid changeover is key to reducing production lot sizes and thereby improving flow. The phrase "single minute" does not mean that all changeovers and startups should take only one minute, but that they should take less than 10 minutes (in other words, "single digit minute"). SMED is the term used to represent the Single Minute Exchange of Die or setup time that can be counted in a single digit of minutes. SMED is often used interchangeably with “quick changeover”.

Process of SMED:

1) Observe the current methodology.
2) Separate the Internal and External activities.
3) Stream line the process of changeover.
4) Continuous Training

K. FMEA

Failure Mode and Effects Analysis (FMEA) is a risk management and planning technique that can be used to identify and prioritize potential errors/failures within a project/system/process and come up with possible solutions to avoid these errors. Identification of potential problems is usually achieved by brainstorming and opinion sharing between experts within the operating field. Failure modes and/or errors are then ranked or prioritized based on a Risk Priority Number (RPN) which is calculated according to three main factors: severity of the risk, frequency of occurrence, and probability of detection.

VI. CONCLUSION

This paper summarized the basic wakefulness of lean manufacturing in small scale industries. In general context by introducing lean manufacturing definition, lean principles, lean waste and lean tools and techniques we are reducing the manufacturing cycle time of small scale industries. These may help to small scale industries to quality product, customer satisfaction, time saving, higher productivity and cost benefits.

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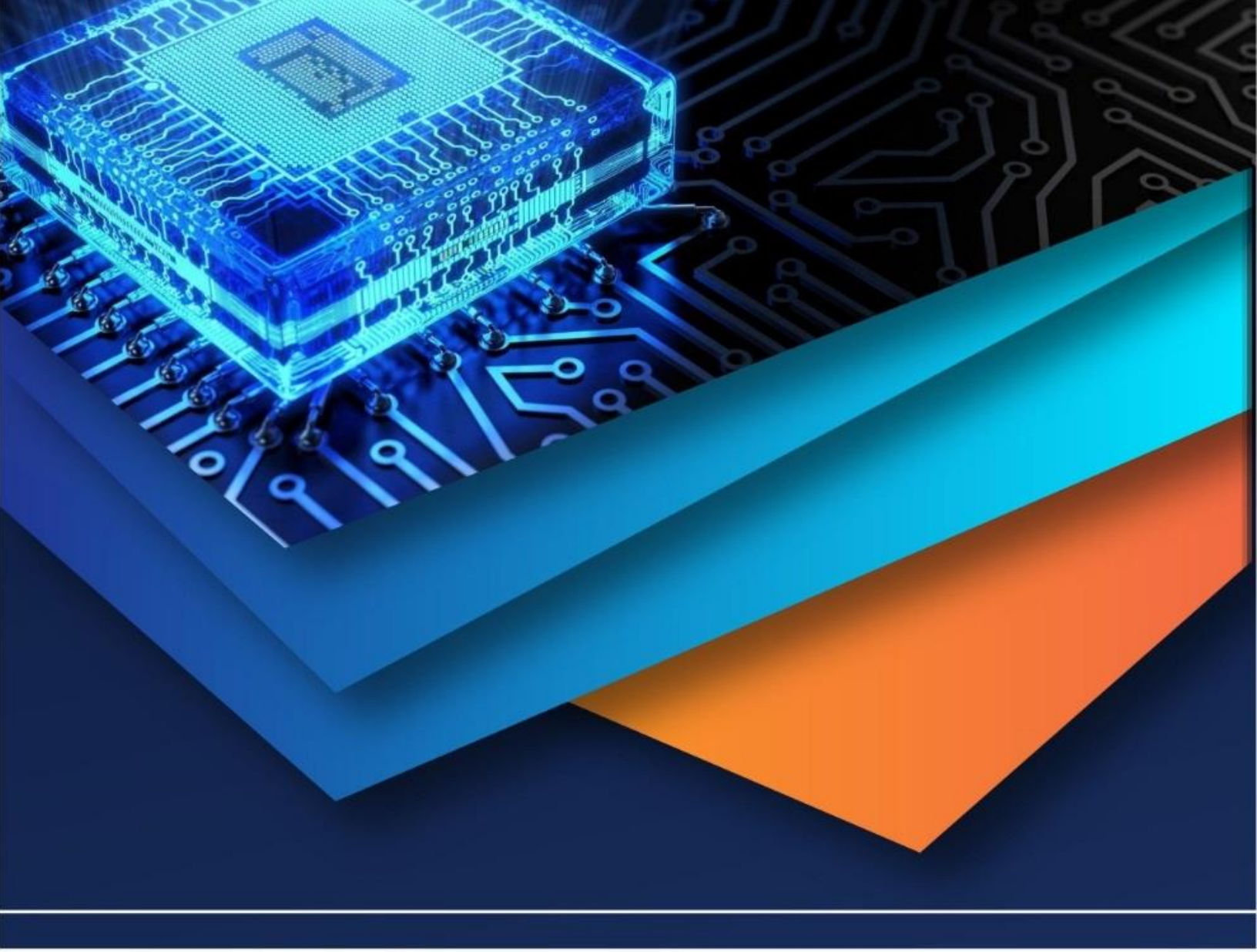

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