iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 12 **Issue:** III **Month of publication:** March 2024

DOI: https://doi.org/10.22214/ijraset.2024.58643

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 12 Issue III Mar 2024- Available at www.ijraset.com

Implementation of Productivity Improvement Techniques in Wood Industry

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Abstract: ***In Industries, it is very important to save time and money in manufacturing products, because there is lots of competition in the industrial world. The main objective of this study is to improve productivity of the wood industry by implementing different types of productivity improvement techniques such as 5S, Lean Manufacturing, JIT, TQM, 6 Sigma, Kanban, Jidoka and PDCA, etc. Improvement can be done by above techniques and by observing the working process cycle and study of the machineries, time study, identifying the problems during process, process analysis, study of inventory management process, and make the solution on the based problems. The purpose of this study is to eliminate the wastes and reduce the idle times in industry.***
Keywords: 5S, Lean Manufacturing, PDCA, Productivity, JIT.

I. INTRODUCTION

The industries are currently facing several critical challenges that have significantly impacted its productivity and efficiency. The production output is falling short of the desired level, resulting in decreased overall productivity and potential revenue loss. To fulfill these requirements, some productivity improvement techniques emerged for better production in the industries are mentioned below. There are 8 techniques used in wood industries such as 5S, Lean Manufacturing, JIT, TQM, 6 Sigma, Jidoka, PDCA and Kanban, etc.

II. DIFFERENT TYPES OF PRODUCTIVITY IMPROVEMENT TECHNIQUES

A. 5S

5S is one of the working tool of lean manufacturing. There are 5 steps of 5S are as follows; Sort(Seiri), Set in order(Seiton), Shine(Seiso), Standardize(Seiketsu), Sustain(Shitsuke). A systematic method to organize the workplace, to keep it neat and clean, to maintain standardized conditions, and to sustain the discipline that is needed for high performance[3].

1) Methodology

Before implementation of 5S, the first step of 5S is formation of 5S council, Setup 5S Zones, Then giving 5S training to the employees and workers, then last but not the least the launching of 5S in the industry. Below there are the steps of 5S are as follows;

- *Sort(Seiri):* Sort or Seiri is the first step in 5S which focuses on sorting necessary and unnecessary items in the workplace.
- *Set in order(Seiton):* Set in order or Seiton is the second step in the 5S. It is the method of creating proper designated locations for all necessary things needed in the workplace.
- *Shine(Seiso):* Shine or Seiso is the third step in the 5S, which is related to cleanliness.
- *Standardize(Seiketsu):* Standardize or Seiketsu is the fourth step in the 5S. Standardizing means to give namings to the parts, inventory materials, etc.
- *Sustain(Shitsuke):* Sustain or Shitsuke is the last step in the 5S. In this step, the previous 4S should be followed[2].

2) Benefits

It decreases searching times and costs, improvement in equipment reliability and maintainability to enhance quality and productivity.

B. Lean Manufacturing Elimination Processes

There are 8 wastes that should be eliminate are as follows; Lean means manufacturing without waste. Waste (“muda” in Japanese) has seven types: waste from overproduction, waiting time, transportation waste, inventory waste, Extra processing waste, motion, Non-Utilized Talent and wastage from product defects[14].

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1) *Methodology:* In lean manufacturing, there are two stages. First stage is to identify defects or problems and eliminate the wastes occurring in machines or in machining process and second stages is to analyze cycle time reduction of machines through lean manufacturing, through waste reduction[23].
2) *Benefits:* It reduces the manufacturing process lead time, reduces waiting time, eliminates the wastes and increases the efficiency.

C. *Just-In-Time*

Just-in-Time (JIT) manufacturing is a production and inventory management system that aims to produce goods and deliver them to customers as they are needed, precisely when they are needed, and in the quantity required. JIT is a key component of Lean manufacturing and was popularized by the Toyota Production System (TPS) [11].

1) *Methodology:* They identify the problems of industry and then make a plan for to how to overcome those problems through various research. Then they make questions of that problems and collect data on that problem for what is the problem and what is the reason for this problem. Then they validate that problem and collect it as question forms. They distribute these questions in various industries and discuss these problems on that industries people, through phone calls or take interviews on that particular problems. Then provide them data on that problem and give solutions. Then they evaluate that results and implemented in industry for better enhancements of that industry[11].
2) *Benefits:* This technique reduces the inventory expenses, reduces insurance and leasing costs, reduces wastes, and helps to increase efficiency and quality.

D. *Total Quality Management (TQM)*

TQM is the process which focuses on the work process and people. It aims to satisfy the customers and improve the organizational performance. TQM is a technique to manage the organization so they directly impact on quality. This technique fulfills the customers requirements[24].

1) *Methodology:* Firstly they design and build the one type of portion to develop the structure of TQM, its processes and make plan for implementing TQM in industry. Then, they ensure the needs of organization and needs of customers going to develop their systems. They break the lengthy process into small processes for easy work[24].
2) *Benefits:* This method increases the product consistency, helps for reducing errors, reduces cost and it also detects future collapse before problem.

E. *6 sigma*

All over the world, various industry adopted the 6 sigma technique for process excellence tools. Six sigma is a set of methodologies and tools processes by reducing defects and errors or increasing quality. Purpose of six sigma is to achieve a level of quality and to eliminate wastages in industry [26].

1) *Methodology:* First to identify and understand the existing production processes. Then collect the data and find defects in production processes. To separate the defective products during processes and their quantity of defective products. Then collect all defective and non-defective products and to understand where defects occur or which product takes more time for manufacturing. Suppose if any defects occur so there will be study on that defect and finding what is the reason behind for idle times. By this way, the six sigma can be implemented and helps to evaluate the processes [26].
2) *Benefits:* It helps to improve bottom line of industry, It gives customers satisfaction, It leads to extending long relationships between two companies.

F. *Kanban*

This process involves two main factors i.e. the lot size and numbers of kanban used in process. The main objective of kanban technique is to maximize productivity of industry and to reduce the idle time of the process. It is easy to implement and if this technique is implemented in the proper manner so it gives better results and reduces cost of industry [16].

1) *Methodology:* This technique is easy to implement in the wood industries. Firstly, collecting the data of the overall process, finding defects and calculating the idle time and then making solutions on the based problems. The solution will help in reduction in idle times in process and also helps to improve productivity and work efficiency[16].
2) *Benefits:* After implementing this technique, It saves idle time of process, It reduces cost of industry, They provide feedback of wrong track of every work and It is very effective technique regarding waste reduction.

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G. Jidoka

Jidoka stands for both technique and a system in the lean manufacturing. Jidoka defines sets of automation, that leads to separate human activity with machine. Jidoka technique that detects abnormalities and further control feedback[20].

1) *Methodology:* Jidoka identifies the causes of problems because when problem occur in machines or process the work stops immediately. This leads to improvements in the processes that build in quality by eliminating the wastes from machines[20].
2) *Benefits:* It reduces wastes of industry, helps to reduce defects, It also helps to use better utilization of resources and helps to reducing employee overworking.

H. Plan Do Check Act (PDCA)

The PDCA is a systematic work of process. It gives valuable learning and knowledge of that product and process. This method gives two types of action: temporary and permanent. Temporary action aims to tackle the problems and permanent action consists of to investigate and eliminating the root causes[17].

1) *Methodology:* The methodology of the PDCA technique is to implement the stages such as PLAN, DO, CHECK, ACT. First stage is "Plan", In this there is identification of the problem and for the solution there is planning to solve it. Second stage is "Do", In this there is testing as per plan. Third one is "Check". In this there is review of how the action Do stage performed and last but not the least "Act". In this implementation of the best solution[17].
2) *Benefits:* Continuous improvement, it increases efficiency and reduces wastes, enhances quality, it increases profitability, increases accountability and enhances communication.

III. COMPARATIVE STUDIES OF VARIOUS PRODUCTIVITY IMPROVEMENT TECHNIQUES

Feature	5S	6 Sigma	Kanban	JIT	TQM	Jidoka	PDCA	Lean Manufacturing
Focus	Workplace organization & cleanliness	Defect reduction & process improvement	Workflow Optimization, Inventory Management	Inventory reduction & just-in-time production	Customer satisfaction & overall quality	Automated defect detection & stoppage	Cyclical problem-solving approach	Eliminating waste & creating value
Implementation	Relatively simple & low-cost	Complex & requires training & tools	Easy to Implement	Requires planning & coordination	Company-wide & cultural shift	Requires machine modificatio ns	Structured & repeatable	Comprehensive framework integrating multiple tools
Implementation Cost	Low	High	Moderate	Moderate	High	Moderate	Low	Varies depending on chosen tools
Internal Resources	Requires commitment from frontline employees	Requires trained specialists & champions	Production staff, Management	Requires supply chain & production planning expertise	Requires commitment from leadership & all levels	Requires engineers & machine specialists	Dedicated team or individual champion	Varies depending on tools used
External Resources	Consultants & training materials available	Consultants, training, & software	Kanban Software, Consultants	Consultants & software	Consultants & training	Consultants & software	Training & facilitation	Varies depending on tools used
Return on equity allowance	Moderate to high	High	Increased production speed.	Moderate to high	High	Moderate	Moderate	Varies depending on specific implementation

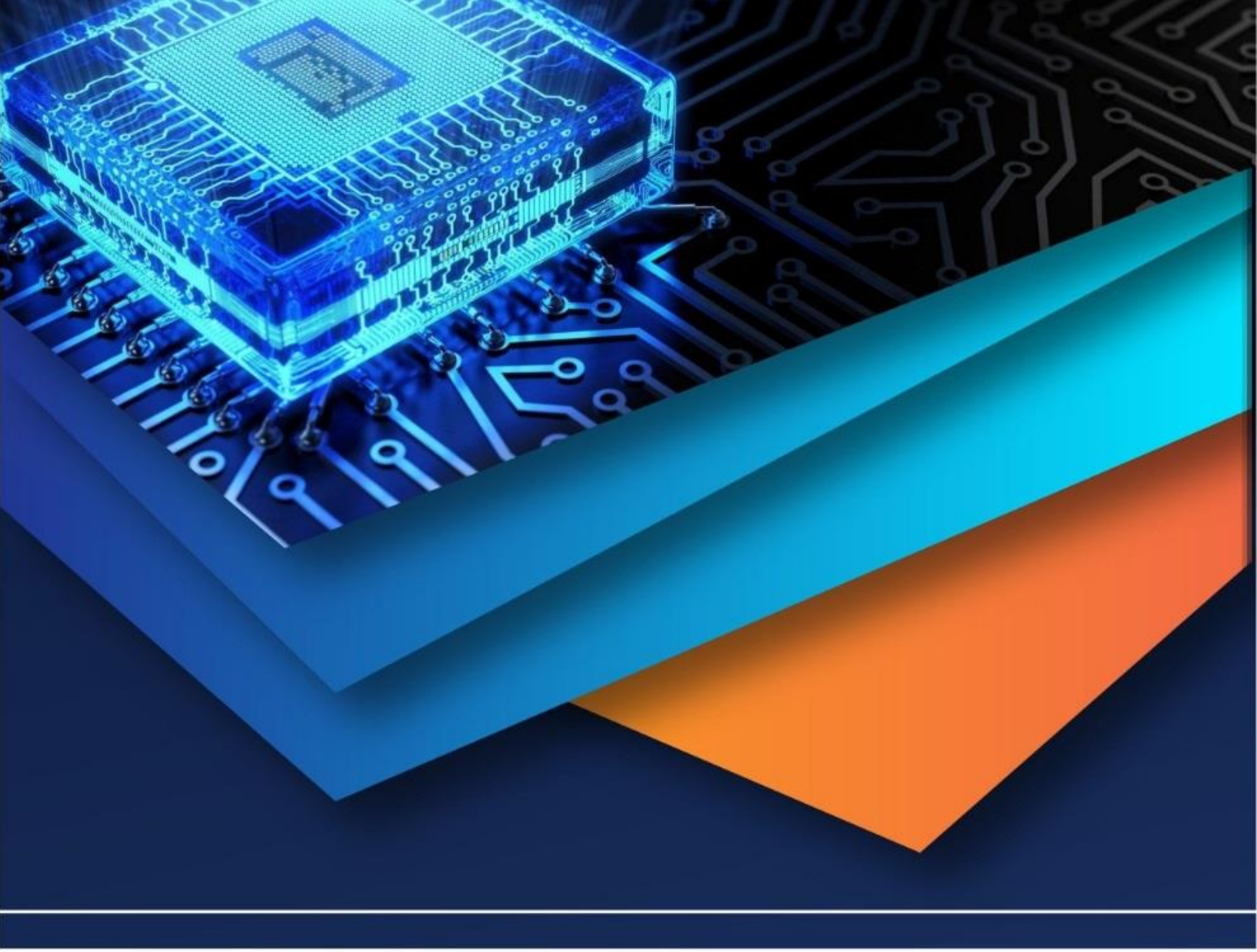
IV. CONCLUSIONS

The study is to conclude that increasing productivity of the wood industry, by applying improvement techniques. The techniques used to reduce idle times of machine or worker, to reduce defects in machine, to increase better workflow and maintain standard work. Implementing any technique in industry, definitely increase their efficiency, minimize their material waste, increase quality of product, to improve customer satisfaction, reduce operational cost, increase output, increase financial performance. From studying the above techniques, implementing 5S will be helpful for the industries, there will be proper workflow, increases efficiency, Lean Manufacturing will help to reduce the wastes, idle times, and increase in productivity and last but not the least the PDCA (Plan Do Check Act) is the important part of planning for the next production processes.

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