

e-ISSN: 2319-8753 | p-ISSN: 2320-6710

# IJIRSET

International Journal of Innovative Research in  
**SCIENCE | ENGINEERING | TECHNOLOGY**



# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 10, Issue 4, April 2021

**ISSN** INTERNATIONAL  
STANDARD  
SERIAL  
NUMBER  
INDIA

**Impact Factor: 7.512**

# Implementation of Process Improvement Techniques in a Manufacturing Facility

Sheik Sulaiman S<sup>1</sup>, Sankara Narayana Jeeva T<sup>2</sup>, Sathishkumar E<sup>2</sup>, Selvakumar B<sup>2</sup>,  
Sheron Varghese<sup>2</sup>

Assistant Professor, Department of Mechanical Engineering, Francis Xavier Engineering College, Vanarpettai,  
Tirunelveli, Tamil Nadu, India<sup>1</sup>

Final year Students, Department of Mechanical Engineering, Francis Xavier Engineering College, Vanarpettai,  
Tirunelveli, Tamil Nadu, India<sup>2</sup>

**ABSTRACT:** Indian MSMEs are an integral part of Indian economy and they are either struggle to improve their production techniques or unaware of implementing continuous improvement techniques. A company can seize extra-ordinary opportunities only if it is very good at the ordinary processes. By improving internal processes, a company is better positioned to offer value to its customers through its products or services. Process Improvement is the methodology of identifying, analyzing, and improving an existing business processes within an organization. In modern industries process improvement or continuous improvement is coined by a term lean. Lean is defined as a system for developing process improvement that is continuous and has a focus on reducing and eliminating waste.

**KEYWORDS:** Lean Manufacturing, concern, cause, poka yoke, SMED, Kaizen, Kanban

## I. INTRODUCTION

Process Improvement is the proactive task of identifying, analyzing and improving upon existing business processes within an organization for optimization and to meet new quotas or standards of quality. It often involves a systematic approach which follows a specific methodology but there are different approaches to be considered. Some examples are benchmarking or lean manufacturing, each of which focuses on different areas of improvement and uses different methods to achieve the best results. Processes can either be modified or complemented with sub-processes or even eliminated for the ultimate goal of improvement. Process Improvement is an ongoing practice and should always be followed up with the analysis of tangible areas of improvement. When implemented successfully, the results can be measured in the enhancement of product quality, customer satisfaction, customer loyalty, increased productivity, development of the skills of employees, efficiency and increased profit resulting in higher and faster return on investment

## II. LITERATURE REVIEW

[1] Bhawesh Kumar, [2] Rakesh, [3] Prakash Kumar Implementation of Poka Yoke in Needle Bearing Assembly Process The journal Implementation of poka yoke in needle bearing assembly process was published at SNL Bearings Ltd utilizing batch sealing strategy or Poka yoke. In their journal they addressed the problem of Missing of needles in needle bearing assembly process. The journal gives the explanation of the assembly line movement and explains the reason to choose poka yoke method as to wipe out the blunder mistakes made by human. The paper shows the use of cause, effect diagram and Is or Is not analysis. As a result of their thesis identified and solved using poka yoka tool the defects dropped from 30% to its maximum efficiency as human mistakes are neglected

[1] Dhruv Shah, [2] Mr. Pritesh Patel Productivity Improvement by Implementing Lean Manufacturing Tools in Manufacturing Industry

A journal titled Productivity Improvement by Implementing Lean Manufacturing Tools in Manufacturing Industry published at International Research Journal of Engineering and Technology (IRJET) Volume: 05 Issue: 03. The paper tried to show the background of lean tools such as JIT, Kanban, Key performance indicator (KIP), TPM. As the journal shows the benefits such as improved productivity and less defects by eliminating the wastes in over production, defects, inventory, motion, over processing, and time.

### III. HISTORY AND CONCEPT

Lean is a concept or way of thinking that focuses on eliminating waste and streamlining processes to save time, space, materials and money. Its name comes from this idea: when excess is removed from a process, it is reduced, or becomes lean. The history of lean involves luminaries such as Toyoda, Ford, Ohno, Taylor and many others. Although many people believe the concept of Lean originated with Henry Ford and Toyota in the 1900s, its roots can actually be traced back to Venice in the 1450s. In the early 1450s, through sequencing and standardizing the process of galley ship building, shipbuilders at the Venetian Arsenal were able to move ships through their entire production line in an hour. By 1574, the Arsenal's process had become so advanced that King Henry III of France was invited to witness one of the galley ships being built from start to finish. By standardizing process flow, the shipbuilders were able to maximize efficiency, quality, and safety, three of the key reasons why manufacturers use this Lean concept today. Although historians can only research and hypothesize about the presence of Lean in ancient times.

### IV. CASE STUDY INDUSTRY IDENTIFICATION

Apple cookware manufacturing facility is situated in SIDCO Industrial Estate, Pettai, Tirunelveli, Tamil Nadu 627010. Apple cookware is an Indian medium scale production industry who put their hands on both inland sales and export by producing pressure cookers of about 2,00,000 units per annum on their brand and other leading brand name



Fig -1: Apple Cookware Manufacturing Company

### V. PROBLEM IDENTIFICATION CONCERNS AND CAUSE

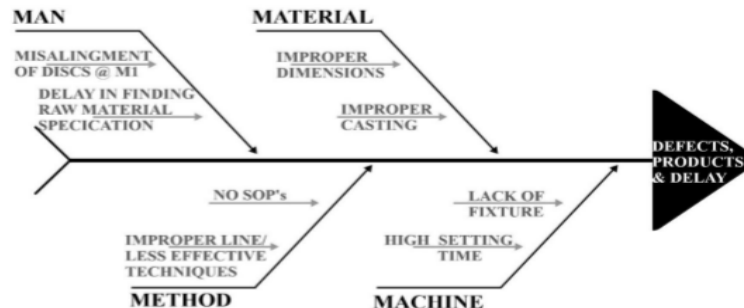
#### Concern

The manufacturer is facing a high demand than the current production rate addition to these they also facing high defect rate which hurts them in both the case of revenue loss and process loss.

#### Cause

To identify cause for the concerns of the manufacturer a brainstorming meeting has been arranged with presence of all major stake holders and project team the data collected on the brainstorming meeting are presented here in the form of fish bone diagram .



**Causes for defect****Table-1 :Defects and its Cause**

| Defects        | Cause                                       | Number of Defects |
|----------------|---|-------------------|
| Strains        | Mineral/impurities deposits in raw material | 108               |
| Discoloration, | Raw material Exposure to alkali             | 48                |
| Dimension      | Misalignments of material at press machine  | 708               |
| Shearing       | Presence of void in raw material            | 60                |
| Bending        | Poor material handling                      | 36                |
| Shearing       | Improper lubrication during drawing         | 23                |
| Dimensions     | Wrong material specification                | 25                |
| Other          | Improper machining                          | 37                |

**Causes for delay****Table-2:Delaying Zones**

| Zone                                      | Reason for delay  | Average time span (s) |
|---|---|-----------------------|
| Drawing (Body & Lid)                      | Alignment of material with die                          | 35.01                 |
| Coining (Body),                           | Movement waste  | 10.23                 |
| Hole piercing (Body & lid),,              | Movement waste  | 8.14                  |
| Shearing (Body)                           | Misalignment at drawing process                         | 12.54                 |
| External polishing (Body)                 | Polishing multiple surfaces at single stage             | 38.89                 |
| External polishing (Lid)                  | Polishing multiple surfaces at single stage             | 34.62                 |
| Internal polishing & Emery coating (Body) | Operating one piece at a time                           | 87.86                 |
| Internal polishing & Emery coating (Lid)  | Operating one piece at a time                           | 93.92                 |
| Riveting & Lid lock                       | Done by single operator following one process at a time | 12.35                 |
| Setting time for Coining (Lid)            | Complex arrangements                                    | 1500                  |

## IMPLEMENTATION

### Proposed solutions

#### Implementation of tools and techniques

- \*Implementation of poka-yoke (Mistake proofing) in drawing punch
- \*Implementation of Kanban approach
- \*Implementation of SMED in coining press (lid)
- \*Implementation Visual management in safety valve and steam vent assembly
- \*Implementation of Kaizen in riveting and lid lock press operations
- \*Implementation of Kaizen in external body polishing operation
- \*Implementation of kaizen in internal polishing emery operations

### 1.Implementation of Poka-yoke

Poka-yoke is a Japanese term that means "mistake-proofing" or "inadvertent error prevention".

A poka-yoke is any mechanism in a process that helps an equipment operator avoid mistakes, defects by preventing, correcting, or drawing attention to human errors as they occur.

#### Need for poka yoke

Man made mistakes in alignment of material with machine at drawing punch is the prioritized factor that effects in both defects and time It is noted from brainstorming that the operator has to be align the material at dies by simply sensing the correct placement of material which results in repeatability error and delay

#### Design modification for drawing punch

To reduce misalignments with die at drawing punch following fixture is redesigned as it can be used in all a available die format.The design is made for mistake proofing which assists operator to avoid mistake..

#### Poka yoke – Drawing punch

- \*The fixture is adjustable and flexible to die changes.
- \*Material used: Velcro tape, wood

#### Observation before lean

- \*Average time taken/ piece before implementation:35 s
- \*Defect rate per million: 60,243
- \*Process loss: 3.54 lacs per annum (important factor for overall process loss)

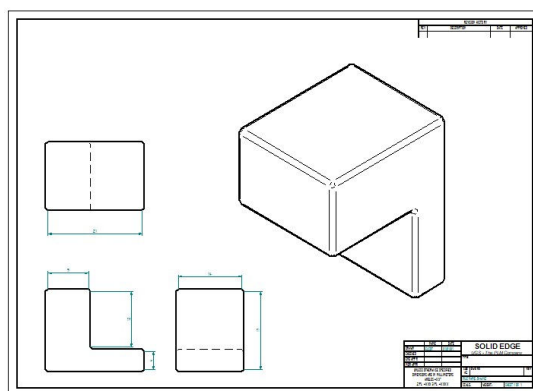


Fig-2:design of drawing punch

**Fig-3:Deep drawing press with adjustable poka yoke fixture****Result**

Productivity increase: 60,000 products per annum\*Profit : 3.54 lacs + Revenue on increased products (per annum)

**Table - 4:Observation at drawing punch**

| Description                         | Before Implementation | After Implementation |
|-------------------------------------|-----------------------|----------------------|
| Processed pieces per day            | 617                   | 812                  |
| Processed pieces per annum          | ~ 1,85,000            | ~ 2,45,000           |
| Defects produced                    | 6.02%                 | 0.05%                |
| Defects per million                 | 60243                 | 493                  |
| Savings due to time saved per annum | Nil                   | Rs.38,675 /-         |

**2.Implementation of SMED at lid coining press****SMED – (Single Minute Exchange of Die)**

SMED is a tool in Lean used to reduce the amount of time it takes to change from running one process in an operation to running another. In addition to improving cycle time in a process, SMED can help reduce costs and increase flexibility within a process.

**Problem and Solution**

In lid coining operation the machine has to be changed from one operation to other frequently as product requirement change in both a way as dimensional change and brand change. Previously setting up the machine is complex and time-consuming process. Since the setting is complex the operator has to wait for an experienced person to set the die. So, the setting time has to be reduced by simplifying the process.



**Fig-4:Coining press**



**Fig-5:Die Changing**



**Fig-6:Position mark on die**

## Result



Fig-7:Coining press after implementation

Before the setting up the die would take the time duration of 25 to 30 minutes. In a day the duration taken for setting die is about 80 to 100 minutes. In the implementation separate colour coding was given to each product dimension and the die position marker was marked hence even less skilled workers can change the die easily and quickly. The machine became flexible and adaptable to increased production. As the result simplification the die change time is about 15 minutes which saves 40 working minutes in a day, 200 working hours in a year.

### 3.Implementation of Kanban approach

#### Kanban

Kanban (signboard or billboard in Japanese) is a scheduling system for lean manufacturing and just-in-time manufacturing (JIT). Kanban maintains inventory levels; a signal is sent to produce and deliver a new shipment as material is consumed. These signals are tracked through the replenishment cycle and bring extraordinary visibility to suppliers and buyers. Kanban became an effective tool to support running a production system as a whole, and an excellent way to promote improvement. Problem areas are highlighted by measuring lead time and cycle time of the full process and process steps.



### Problem and Solution

Before implementation the inventory management was done visual inspection of stock which was inefficient and a cause for delay. Addition to that picking up the right material with right specification was complex and time-consuming unnecessary delay. Then the material has to flow in a way one after one but there is no control or monitoring in the flow which causes critical situation at various zones, unwanted confusion, jam of materials at various zones. To solve this issue Kanban approach is designed to help the manufacturer to have monitoring over processing goods, processed goods, and goods at raw material storage which prevents the waiting of materials. Kanban route cards will flow along the material in the shop line once they out from raw material storage. While stock out the raw material a similar card will hold a place on Kanban board which indicates the amount of goods are out for processing. Once the Kanban route cards are in flow it signals the operators of next process to clear out. At the end of the flow, after delivery the corresponding route cards will placed on Kanban board indicating delivered goods, which the supervisor can calculate amount of goods are currently in processing and can optimize the amount of goods can be processed at a time



Fig- 8: Waiting materials for processing



Fig-9: Kanban route card



Fig-10: Kanban board

### Result

After implementation of Kanban which assists the concern supervision on just in time production and stock & inventory management. Kanban cards gives the visual management over process, delays and helps in achieving pull production. The Kanban board uses the Kanban cards on board to convey data of in stock, processing goods and inventories. The unnecessary delays are avoided

#### 4.Implementation of Kaizen

##### Kaizen

Kaizen is a Japanese term meaning "change for the better" or "continuous improvement." It is a Japanese business philosophy regarding the processes that continuously improve operations and involve all employees. Kaizen sees improvement in productivity as a gradual and methodical process. The concept of kaizen encompasses a wide range of ideas. It involves making the work environment more efficient and effective by creating a team atmosphere, improving everyday procedures, ensuring employee engagement, and making a job more fulfilling and less tiring

##### Problem and Solution

##### Kaizen - Rivet, Lid lock, Polishing, Emery.

\* Riveting and lid locks are machined by same operator in closely located different machines separately is Planned to Do at once as one piece at a time. Its done checked as better performance

\* In polishing it is planned to done as one process at a time as three operators and three machines are available.(Splitting the operation as: polishing lateral surface; corners and face)

\* Similarly in internal polishing and emery section it is planned to split available four machines as separate polishing and emery operation (reason: internal polishing is faster then emery coating)



Fig-11:External polishing



Fig-12:Internal polishing

**RESULT****Improvement**

The result of the implementation is listed in the following table taking average data on random 5 days before and after implementation of lean techniques

| Area of improvement    | Performance improvement         |
|------------------------|---------------------------------|
| Production per day     | 220 products increased          |
| Defects per day        | 37 defects controlled (Approx.) |
| Productivity per annum | 66,000 products rise            |
| Profit through savings | Rs. 2,00,000 per annum          |
| Revenue                | 30% increased income            |

**VI. CONCLUSION**

Apple cookware, an Indian medium scale industry is considered for implementing the process improvement techniques and understanding the benefits of these techniques. The industry was selected and their operations and techniques they follow were learned. Problems in operation of industry, limitation of the company and the processes are identified. The overall productivity of the company is improved about 20% of overall production as a result of Kanban approach. Over 1.3 lakhs per annum is savings of the manufacturer due to the kaizen ideas implemented at polishing, emery and riveting zones. 59% of Defect reduction by mistake proofing system at drawing operation avoids the process loss of about rupees forty thousand. Implementation of SMED at lid coining operation not only saves time and money also gives the awareness of lean tools to the workers. Overall defect reduction, removal of unnecessary delays, proper inventory management and process management gives the overall savings of about 5 lakhs per annum. Productivity increase at delaying zones gives the manufacturer, estimated revenue increase about 30% over the year. The awareness of safety equipment and accessories is raised. Ideas suggested during the period of evaluation such as kaizen, PDCA, 3C, 5S and benefits of lean manufacturing gives the hope for continuous improvement.

**REFERENCES**

- [1] Bhawesh Kumar, Rakesh, Prakash Kumar.: Implementation of Poka Yoke in Needle Bearing Assembly Process, International Journal of Engineering Science Invention, Volume 6 Issue 11, November 2017
- [2] Dhruv Shah, Mr. Pritesh Patel.: Productivity Improvement by Implementing Lean Manufacturing Tools in Manufacturing Industry, International Research Journal of Engineering and Technology, Volume: 05, Issue: 03, March 2018.
- [3] Harish U.C.: Implementation of Theory of Constraints (TOC) in a Manufacturing Plant, International Journal of Advanced Scientific Research and Management, Volume 4, Issue 5, May 2019.
- [4] Hernadewita, Feri Ali Tosa, Yadi Santoso, Lien Herliani Kusumah, Hermiyetti.: Application Poka-Yoke to Capture Defect (A Case Study in Industry Component Otomotive), SSRG International Journal of Industrial Engineering, Volume 6, Issue 1, Jan to April 2019
- [5] Muthukumaran.V, Hariram VR, Padmanabhan.K.K.: A Research on Implementation of Lean Tools Across Verticals in Manufacturing, International Journal of Engineering and Advanced Technology, Volume-8, Issue-6S, August 2019
- [6] R. S. Agrahari, P.A. Dangle, K.V.Chandratre.: Implementation Of 5S Methodology In The Small Scale Industry: A Case Study, International Journal Of Scientific & Technology Research, Volume 4, Issue 04, April 2015.
- [7] Ramiz Assaf, Tamer Haddad.: An Application of Single Minute Exchange of Die Approach in an Aluminium Profiles Extrusion Production System: Case Study, International Journal of Scientific Research and Innovative Technology, Volume 4, Issue 07, July 2017.
- [8] Saima Akter, Farasat Raiyan Yasmin, Md. Ariful Ferdous.: Implementation of kaizen for continuous improvement of productivity in garment industry in Bangladesh, American Academic & Scholarly Research Journal, Volume 7, Issue 3, May 2015
- [9] Tejas Chaudhari, Niyati Raut.: Waste Elimination by Lean Manufacturing, International Journal of Innovative Science, Engineering & Technology, Volume 4, Issue 5, May 2017.
- [10] Vignesh Ravichandran, N.Ganesh Kumar.: Implementation Of Kanban System For Inventory Tracking And Establishing Pull Production (A Case Study), International Journal Of Advances in Production And Mechanical Engineering, Volume-1, Issue-3, 2015.





**Impact Factor:  
7.512**



# **INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH**

**IN SCIENCE | ENGINEERING | TECHNOLOGY**

**9940 572 462 6381 907 438 ijirset@gmail.com**



**www.ijirset.com**

Scan to save the contact details