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Elimination and Combination of Processes Through Kaizen Practice

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Abstract - *Every organisation faces a problem of productivity as well as quality issues. This case study deals with the kaizen implementation in an organisation which manufactures magnetic cores in India. Implementation of kaizen technique has tremendous effect on old process followed in organisation. This kaizen technique influences on designing, developing and implementing new process in order to combine two process an eliminating one separate process.*

***Key Words*: Kaizen, 3D modelling, Prototype development, Reduced manpower, Process flow analysis, Costing,**

1.INTRODUCTION

The main aim of any organisation is to satisfy customer demand with quality products. One of the biggest challenge is increased productivity and reduced cost. Wastes during manufacturing leads to increase in production costs. Kaizen is a daily process, the purpose of which goes beyond simple productivity improvement. It is also a process that, when done correctly, humanizes the workplace, eliminates overly hard work , and teaches people how to perform experiments on their work using the scientific method and how to learn to spot and eliminate waste in business processes.

The cycle of kaizen activity can be defined as:

- Standardize an operation and activities.
- Measure the standardized operation (find cycle time and amount of in-process inventory)
- Gauge measurements against requirements
- Innovate to meet requirements and increase productivity
- Standardize the new, improved operations
- Continue cycle

Kaizen helps to:

- Reduce the human efforts
- Increase the productivity
- Reduce the strain of operator
- Reduction the manufacturing cost
- Improve the quality

This study was motivated by company's process engineer. Management decisions are also very important while changing to new processes. It isalso important to give attention towards workers whether they are successfully adjusting to changes. This study focuses on Implementation of prototype and how new operation could be implemented. This kaizen system could improve company's strength.

2. LITERATURE REVIEW

The word indicates a process of continuous improvement of the standard way of work (Chen et al., 2000). It is a compound word involving two concepts: Kai (change) and Zen (for the better). The term comes from Gemba Kaizen meaning 'Continuous Improvement' (CI). Continuous Improvement is one of the core strategies for excellence in production, and is considered vital in today's competitive environment.[1]

Kaizen events have been widely reported to produce positive change in business results and human resource outcomes. However, it can be difficult for many organizations to sustain or improve upon the results of a Kaizen event after it concludes. Furthermore, the sustainability of Kaizen event outcomes has received limited research attention to date(Glover, 2010, Virginia). The factors that were most strongly related to each Sustainability Outcome were identified. [2]

Kaizen can play the role even in the part of employee management, as maximum workers are not appointed on the basis of qualification and as their job need just physical efforts. The whole emphasis placed on the three vital elements named Teamwork, Flexibility and Quality. (Rajat P. Kale, 2015) Kaizen management is dedicated continues improvement in every field (department) of the industry i.e. Productivity, Efficiency, Quality etc. [3]

(Rajesh Gautam, 2012), This case study deals with the kaizen implementation in an industry in an assembly line in India that manufactures front and rear axle for heavy and medium vehicles. Kaizen technique has tremendous effect on operations of a firm, including design, distribution, marketing etc. and thus all level of a firm's management. A case study is presented to motivate practitioners to implement in small & medium scale Industries. [4]

(JrJung Lyu, 1996) This paper proposes a framework to integrate kaizen and automation to reengineer a manufacturing process. A case project shows the procedure of process reengineering. This study concludes that using an animated simulation model is an important step during process redesign. This research also shows that a nearly 50% improvement in labor productivity at the case company is possible with the streamlined manufacturing process. [5]

(R. Radharamanan, 1996), In this paper kaizen philosophy is applied in a small-sized custom-made furniture industry for continuous improvement and to develop the products with higher quality, lower cost, and higher productivity in meeting the customer requirements. [6].

3. CASE STUDY:

Quality control department is concerned with 'Burr-free' components. 'Burr-free' means having no loose material at the edge and having nothing visible to the naked eye that will cause functional problems in ensuring assembly processes. Burr is usually raised edge or unwanted material and is necessary to be removed by deburring tool. Edge quality is concern of the performance, safety, cost, and appearance of a part.

Cut core (EE core, UU core) products which are produced by pressing the powder on press machine goes through succeeding processes such as sintering, deburring and grinding. After pressing sand, particles get attached at the edge of component. Burrs are generated as a result of clearance between die and punch on press machine. Current Deburring process can be eliminated and alternative process can be developed since it is important operation as quality and safety is concerned. Current deburring process consumes considerable energy (electricity, water), manpower. Deburring process currently increases material handling in terms of product orientation.

The purpose of this project is to improve current deburring processes and look for implementation possibilities for new deburring methods. The aim is to analyse present method to find for problems and develop proper improvement suggestions to solve them. As a conclusion for this project, a general analysis should be made of current problems and implementing new deburring methods by establishing a best deburring method.

Problems faced :

- Number of workers like to be exceeds in production line
- Product cost
- Quality maintaining problem
- System for simplification

4. IMPLEMENTATION PROCESS

These problems were discussed to managerial personals, engineers and operators levels, by considering different factors and found to be improved by using Kaizen. One of the major objectives in implementing Kaizen System is to achieve a common goal of the whole company. The main thing to implement kaizen is improve the level of training, continuous improvement programs.

Figure 1: Process Flow (Before Kaizen)

Table 1: Stage wise manpower required (Before Kaizen)

Sr. No.	Processes	Manpower required
1.	Pressing -Unloading	 1
2.	Sintering - Loading - Unloading	 1 1
3.	Deburring	1
4.	Grinding - Stacking - Loading - unloading	 3 2 1
Total		10

Here, we see that deburring is the operation carried out separately. This operation increases the further work of stacking before grinding operation. Thus, manpower used inefficiently and increased material handling. An alternative to this process can eliminate this additional process and 3 manpower required for stacking.

4.1. Designing of Prototype

Considering the requirements of mechanism, prototype was designed. Factors such as performance, safety and cost are important while developing an prototype. Prototype was designed on 3D software known as CATIA V5R19.

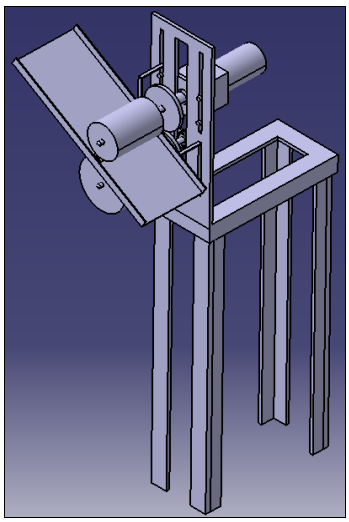

Figure 2: Prototype Design

Further this prototype was developed and implemented on the press machine. The Components get automatically deburred and unloaded on the tray.

4.2. Working

Rotary brush is fixed on a shaft and shaft is coupled with motor shaft. As shown in drawing motor height is adjusted as per the height of tray on machine. Motor is attached to gear box for speed control. Maximum motor speed is controlled to 12 rpm. This speed of motor is sufficient to push the components towards worker for unloading purpose.

The automatic cleaning mechanism rests on floor and in front of press machines. The soft bristle nylon brush just touches the tray fixed in front of press machine as shown in fig. Components pass through rotating brush as soon as collected on the tray. Rotating brush will remove burr from top side of component and a fixed brush below tray will remove burr from lower side of component.

Components get automatically pushed further. Unloader will unload components without interfering the mechanism. Also there are no safety issue observed. Below fig shows the actual working of cleaning brush.

Figure 3 : Automatic cleaning brush

4.3 Observations

1) There are no safety issues while working.
2) No manual stress on worker after installing the prototype.
3) No issue while unloading the components.

4.4 Implementation Cost

Cost analysis for the implementation of automatic deburring tool is illustrated in following table:

Table 2: Implementation Cost

Operations	Unit of Measure	Qty	Rate (Kg/Job/Hour/Man day)	Amount
Raw Material				
MS Plate 500 x 200 x 5	kg	4	40	160
Angle Bar 5000 x 50 x 50 x 5	kg	18	40	720
Brush	nos	2	1500	3000
Geared Motor 0.5 hp	nos	1	12258	12258
Shaft 15D x 255L	nos	2	65	130
Coupling	nos	1	1000	1000
Chute-(SS304-500 X 200 X 2---1 nos)	kg	1.5	250	375
Electrical Items(ON/OFF,RYB,LCB etc)				3000
Labour charges				1000
Total ===>				21643

5. IMPROVEMENT AND SAVINGS

5.1 Improved Process Flow & Reduced Material Handling

Figure 4: Improved Process Flow (After Kaizen)

Compared to Process flow(Before kaizen), improved process flow is more convenient as one of the whole process get shifted or combined to another process. If we see both flow process charts, material from sintering stage move towards deburring stage in current flow process and in improved flow process material from sintering stage move towards grinding stage. Therefore, material handling is reduced.

5.2 Reduced Manpower

Table 3: Manpower Required (After Kaizen)

Sr. No.	Processes	Manpower required
1.	Pressing & Brush cleaning -Unloading	1
2.	Sintering - Loading - Unloading	1 1
3.	Grinding - Loading - unloading	2 1
Total		6

From Table 1 we saw that Stacking of components at pre-grinding stage consumes more manpower. Therefore, application of new process will eliminate the stacking process and no more manpower is required. As current deburring process is totally eliminated, one more manpower is saved. As of total, 10 manpower required is reduced to 6.

Table 4: Annual Savings (After Kaizen)

Present case	Proposed case	Remuneration per month (₹)	Savings per month (₹)	Annual savings (₹)
Manpower per day	Manpower per day			
10	6	12,500	50,000	6,00,000

5.2 Electricity Saving

Table 5: Electricity Consumption

Machine	Power (Watt)	Consumption/hr
Vibratory Deburring Machine	495	0.5
Automatic Brush Cleaning Machine	90	0.09

5.4 Environment Friendly

Vibratory deburring machine generates unbearable noise. Worker continuously waiting near to the vibratory machine until the deburring process is completed. This seems very dangerous for his health and may cause harmful causes.

Vibratory deburring machine consumes considerable amount of water while deburring. For every batch continuous water supply has to be maintained to get smooth surface. If we adopt new method of deburring, there is no requirement of water for removing burr. Thus water saving is economical and environment friendly process.

6. CONCLUDING REMARK

In this paper, a case study is presented with the objective of discussing the implementation Kaizen in the industry. Kaizen is a philosophy that needs the involvement of all people in the company. A company should focus on eliminating wastes and improving the productivity. By implementing new techniques rejection could be reduced. Continuous improvement is a key goal for healthy company. This kaizen technique proves that improvements could done with lower manufacturing costs and higher quality.

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