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Study and Analysis of Cost Reduction Techniques by Scrap Utilization of Press Part Production: A Case Study of Stamping Unit

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Abstract: ***In this paper, industrial engineering and management tools like TQM, TPM, JIT, Value Analysis & Value Engineering, Lean manufacturing, Kaizen etc. have been studied and analyzed for cost reduction in a specific production process of an auto ancillary industrial firm. For this a case study was performed on sheet metal stamping process of LCV/HCV body parts at XYZ Company at Pithampur (Indore)M.P.. A survey in interview form was conducted among managerial and engineering professionals from various similar type industries. The survey is based on cost reduction techniques, related challenges, market role etc. Attempts have been made to investigate the role of vendors in cost reduction and the problems faced from their side. Application of job plan in investigating the problems in waste management by scrap utilization has also been studied. The outcomes have been analyzed and discussed in details.***

Keywords: Cost reduction, waste management, scrape utilization , Kaizen etc.

1. Introduction

An industrial organization needs sustainable design analysis and process optimization in manufacturing and service for controlling production cost. There is always demand for quality improvement with product price drop from end users. Share and stock holders also anticipate excellent rate of returns against investments. Thus, cost has become a residual. The challenge is to manufacture or provide service within the stipulated cost frame work. Thus, cost management has to be an ongoing continuous improvement programme. Today the market leaders are even pursuing cost reduction as strategic imperative. They want to stay ahead of the market by continuously widening the gap between their cost and that of their competitors and re-deploy the recourses for profitable growth. The project will focus on impact of cost control and cost reduction techniques in present scenario.

A business enterprise must survive, grow and prosper only if the unwanted cost must control and reduced necessarily. There is now a cut throat competition from various concerns of the world.

As a result there is now a raise to secure a place for survival. This has increased the importance of cost control and cost reduction. Hence it is required to study the different tools and techniques used for the same. We can classify the cost according to their nature, behavior then we can easily know the cost which can be controlled or reduced. Here more emphasis is on the controllable and non- controllable cost, because this classification of the costs helps us understanding what and how we can control. If the cost can be controlled then what steps should be taken for controlling purpose; if cannot be controlled, what should be done. It totally depends up on the managerial decisions and it is the activity of management accounting. The study identifies the scope in manufacturing industry by means of conventional methods/techniques like TQM, TPM, Kaizen, Lean manufacturing, Value analysis &Value engineering, JIT etc. in different areas.

The interview sessions are conducted to get the opinion about modern methods for reducing cost in their organizations.

2. Literature Review

There are some techniques/concepts is being studied to benefitting different areas of the organizations, also Identify the process which can reduce their cost and improve working environment.

2.1 What is Cost and Cost Reduction

"An amount, that has to be paid or given up in order to get something. In business, cost is usually a monetary valuation of effort, material, resources, time and utilities consumed, risk incurred, and opportunities for gone in production and delivery of a goods or service".[1]

"Cost Reduction is to be understood as the achievement of real and permanent reduction in the unit cost of goods manufacture or services rendered without impairing their suitability for the use intended". [1]

2.2 What is TPM

In 1971, Nippon Denso Co., Ltd. first introduced and successfully implemented TPM in Japan. They won the Japan Institute of Plant Maintenance (JIPM) PM Excellent Plant Award for their activities. This was the beginning of TPM in Japan. Since then, TPM has spread progressively throughout the world and established itself as a renowned

cultural improvement programme. First example of TPM used in Europe to deliver world class performance was by Volvo in Ghent, Belgium, who won the PM prize for their work in the paint shop. This was quickly followed in the early 1990s by other European automotive companies trying to close the productivity and quality gap to their Japanese competitors.[7] Unilever, Wrigley, Tetra Pak, Heineken and Arcelor Mittal.

The Japan Institute of Plant Maintenance (JIPM) approach to TPM

The JIPM definition of TPM is:
T = Total. Must involve all employees at all levels of the organization.
P = Productive. Effective utilization of all resources.
M = Maintenance. Keeping the Man-Machine-Material system in optimum condition.
JIPM developed an eight pillar approach to TPM focused on achieving:
•Zero Accidents
•Zero Break-downs
•Zero Defects

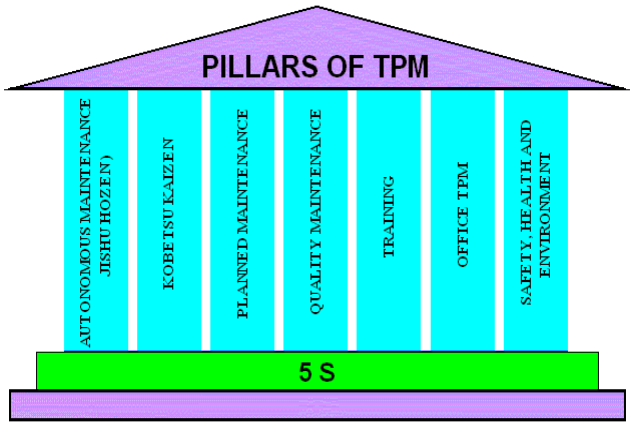

Figure 2.1: Pillars of TPM

2.3 Total Quality Management

Total quality management is a general philosophy of gradually improving the operations of a business. This is done through the application of rigorous process analysis by every involved employee and business partner. TQM is usually applied at the tactical, front-line level, where production, clerical, and low-level managers are deeply involved. There are a number of tools available to assist in a TQM effort, such as: [3]

- Benchmarking
- Failure analysis
- Plan-do-check-act (PCDA) cycle
- Process management
- Product design control
- Statistical process control

2.4 Value Engineering & Value Analysis

The Value Engineering (VE) technique emerged during the years of World War II at General Electric Company, USA. Mr. Lawrence D. Miles of General Electric Company was assigned the task of ***"finding, negotiating for and getting"*** a number of vital materials that were in short supply. Invariably suppliers declined to supply. In this desperate situation, Miles was forced to basics. Whenever he was faced with serious shortages, he aimed at getting the product functions met by some alternate means. Repeatedly there was a way to do it. Miles often found that many of the substitutes used were providing equal or better performance at less cost. The function approach proved to be effective. [4]

With active support of his superiors Miles developed and refined the technique that he called as "Value Analysis" (VA). Based upon the success experienced by General Electric, the concept soon spread throughout private industry because of its ability to yield a large return for a relatively modest investment.[4]

2.5 Lean Manufacturing

The fundamental philosophy behind Lean Manufacturing is to provide superior quality products for more Customers at a significantly lower price and to contribute to a more prosperous society. [5]
It is important to build a Company production system based on this philosophy. Lean Manufacturing has Endeavour to rationalize production by:

- To completely eliminating waste in the production process
- To build quality into the process
- To reduce costs - productivity improvements
- To develop its own unique approach toward corporate management
- To create and develop integrated techniques that will contribute to corporate operation.

2.6 Kaizen

"Kai" means change, and "Zen" means good (for the better). Basically kaizen is for small improvements, but carried out on a continual basis and involve all people in the organization. Kaizen is opposite to big spectacular innovations. Kaizen requires no or little investment. The principle behind is that "a very large number of small improvements are move effective in an organizational environment than a few improvements of large value. This pillar is aimed at reducing losses in the workplace that affect our efficiencies.[7]

2.7 Just-in-Time inventory system:

When considering the costs of housing inventory, it is important to distinguish between value added activities and non-value added activities.[21]

- Value added activities add value to a product or service at a given stage in the production cycle or supply chain; customers are willing to pay for value added activities because they make the product or service better.
- Non-value added activities increase the final cost of the product or service, but do not increase the value to the customer.

The cost of warehousing inventory is a non-value added activity. Upon receiving merchandise, your customer's only concern is, "Does it work and is it going to perform the function for which it was purchased?"

Just-in-time (JIT) purchasing and just-in-time production help combat these undesirable, non-value added inventory costs. These demand-pull inventory systems are applied by requiring that raw materials arrive in your warehouse exactly as they are needed for production or distribution. The goal of JIT systems is to eliminate all non-value added activities.[20]

3. Research Methodology

As we know, any product is made of different parts used to perform the desired function. The cost of that product includes cost of all parts used inside it. Many times we are observing that, large scale manufacturing industries purchases some parts (used in the product) by the vendors or suppliers. Such parts are known as bought out parts (BOP). As we have discussed earlier that the profit maximization is depends on cost reduction and there are many ways to reduce unwanted cost of product or process. [24]

The price of bought out parts are depends on their cost of manufacturing. If we analyze the scope of cost reduction in bought out parts, then it can improve the overall profit of that product.

The above thought was encouraged me to conduct a study in supplier industry to find out the scope in cost reduction comparing with the cost reduction techniques used in present large scale Original Equipment Manufacturing (OEM) Industries.

To understand the working of such manufacturers and their focus towards the cost reduction for betterment, The Interview sessions are conducted with different area of personnel to discuss their experiences on cost reduction techniques used in their respective organizations.

3.1 The Interview Sessions:

Following are the general information of the personnel.

Table 3.1

S.N.	Designation /Area of work	Age	Gender	Work Experience (Years)	Organization	Remarks
Mr. D. Tare	R&D	35	M	10	TATA Tech.	Design and Service Industry
Mr. R. Plotra	Prod.	30	M	5	Bridgestone	Tyre Industry
Mr. Swapnil Saxena	Prod.	29	M	4	TATA Motors	Automobile Industry
Mr. Pulin Sharma	Maint.	30	M	5	Bosch India	Automobile Industry
Mr. Paresh Sharma	Opt. Maint.	31	M	7	J.P. Cement	Cement Industry

(General Information about Personnel for Interview)

3.1 Questionnaire

Following Questions were asked to above personnel of different organizations to know their experiences about present cost reduction techniques.

1. What type of cost reduction technique is being used in your organization?
2. How this technique is being used in organization? (brief description)
3. For how long you are using this technique?
4. How your organization gets benefited by this cost reduction technique?
5. What types of challenges you are facing, while implementing of this technique?
6. Is there any scope after achieving at certain level by this technique?
7. Would you like to continue this cost reduction technique, while introducing new product/ process line?
8. Is your current cost reduction technique gives satisfactory solution to achieve your organization goal.
9. How the market affects the cost reduction technique?
10. How much business relation affects by cost reduction technique?

3.2 Outcome of Interview Sessions

As per the discussion with above personnel followings points are noted:

1. There are many activities but Lean Manufacturing, and Kaizen are using frequently
2. Every organization is using technique according their management objective
3. Cost reduction techniques are using more from last 10 years
4. Every organization is getting benefit.
5. There are some common challenges like resource, manpower resistance etc.
6. Scope of cost reduction is there by changing techniques.
7. Sometime techniques need to change.
8. Depends up on focus and seniority of management.
9. Depends on market conditions, if sales is down then profit does not affect.
10. Improve business relations.

3.3 Company Profile

An auto ancillary is being selected for conducting study. This company is middle scale organization manufacturing press parts for OEM's.

3.4 Job Plan

The methodology (referred to as the "job plan") can be applied to any subject or problem. It is a vehicle to carry the project from inception to conclusion. By adhering to certain formalities. So the ultimate goal of Kaizen strategy and activities aim at improving Quality, Cost, and Delivery (QCD), thus QCD target has become a top priority for survival in business. On the instruction given by management for cost reduction activity by scrap utilization.

The Kaizen is being planned to achieve the goal. For that following methodology is adopted.

P- Plan: Define the problem and prepare for study is to be conducting.
How it is done: -Two teams are forming for indentify the scope in scrap utilization. The targets for improvement and evaluation factors while building cohesion among team members. Collection of Bill of material (BOM) from PPC department and operation standards (ISO 9001:2000 & TS 16494) of above press parts from production department. All the relative information were mentioned in BOM and operation standard.

D – DO: Apply the technique by filtering ideas coming out in brain storming sessions, and finalizing the work schedule
How it is done: - Scarp utilization is depends on part's geometry, grade of material, annual production quantity and fitment of part. All these perametres are examined under the scheduled tool trial. The results of tool trial and quality check are noted. Calculation of total cost saving during waste management.

C- Check: Monitor the results How it is done: - Check the 5 sample parts after each operation and compare with standard part and operation standard. The machine parameters are observed during the trial time.
The results are calculated on the basis of different criteria.
A – Act: Standardize the process
How it is done: - Document the results and prepare the presentation for management approval.

3.5 Problem Identification

3.5.1 Waste management (Scrap utilization)

The scrap is basically the waste material, although it is sold out. The supervisor has an opportunity, if he can utilize that scrap for useful work, sometimes it uses to make another part of same grade. Such practice saves extra material to purchase and save cost.

Recycling has become increasingly important to society and industry to meet the goals of cost reduction, efficient management of limited resources, and reduced landfill utilization. We are accustomed to hearing the three R's of recycling (reduce, reuse, recycle) to include paper, plastics, bottles, cans, and cardboard; however, many people do not know that you can recycle metal as well. Recycling metal reduces pollution, saves resources, reduces waste going to landfills and prevents the destruction of habitats from mining new ore.

"Scrap-recycling facilities are like mines above ground, rich with resources that can be reused to preserve the environment, at a fraction of the cost to mine and refine metals from virgin ores. Scrap metal is not waste or trash. Rather, it is a continuous resource – made from old automobiles, appliances, buildings, bridges, airplanes and more. Scrap metal may, in fact, be one of our most precious resources. Because it can be re-melted and reshaped into new products countless times, scrap metal is a resource that will never be depleted."

a) Environmental Benefits
Metal recycling conserves natural resources by reducing greenhouse gas emissions and using less energy than making metal from virgin ore. The production of new metal releases a far greater amount of greenhouse gas emissions compared with making products from recycled metal. These emissions may influence climate change and may also cause harmful levels of air pollution in cities, resulting in potential respiratory health problems for you and other residents. The Institute of Scrap Recycling Industries (ISRI) reports that recycling metal may cut greenhouse gas emissions by 300 million to 500 million tons. In addition, using scrap metal in lieu of virgin ore generates 97% less mining waste and uses 40% less water, according to the National Institute of Health.

b) Energy Conservation
The amount of energy saved using various recycled metals compared to virgin ore is up to:

- 92 % for aluminum
- 90 % for copper
- 56 % for steel

According to the U.S. Environmental Protection Agency, if you recycle a single aluminum beverage can, you help conserve enough energy to power a 60-watt light bulb for more than four hours. After implementation of job plan the press part of 'Outer Panel Fender' LCV/HCV is identified, which has scrap size of 1.2 x 730 x 1210 mm^3 Grade 'EDD' is suited to 'Plate Step A' HCV of blank size 1.2 x 380 x 1180 and Grade 'EDD'

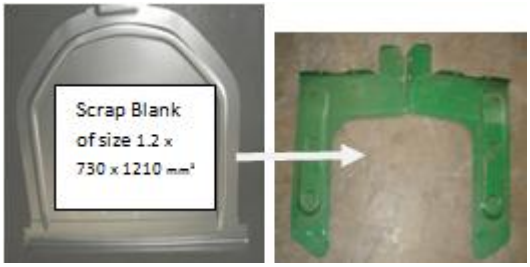

Figure 3.1: Scrap of outer panel fender LCV used for Plate step A HCV

4. Results & Analysis

4.1 Waste Management (Scrap Utilization)

After applying the job plan for waste utilization of sheet metal the part outer panel fender's scrap is shear to the size equal to press part Plate step A HCV and calculations are done on the basis of observations during trial.

4.1.1 Observation

S.N	Material used in new part name	Scrap is utilized in making some other parts	No. of parts made by scrap material	Annual requirement as per BOM	Grade of material	Trial results
1	Outer Panel Fender LH/RH	Plate Step A LH/RH IA209003B Grade "D" HCV	01	3000	D	OK

(Observation table of press part)

4.1.2 Calculations

Part blank (PLATE STEP A)
Length = 1180mm
Width = 380mm
Thickness = 1.2mm
Total volume = 538080 mm^3
Weight = volume X density X g
= $538080x7.85x10^{-6}$
= 4.22 kgf
Raw material cost per part in Rs. = Weight of blank x market rate of 'D' grade material = 4.22 x 46.5
= **196.23/-**
Scrap cost per part of required size = Weight of blank x market rate of 'EDD' grade material scrap
= 4.22x24
= **101.28/-**
Net savings per part in Rs = Raw material cost per part in Rs - Scrap cost of required size = 196.23 - 101.2
= 95.04/-
Savings cost of grade change per annum = Net savings per part in Rs x total vehicle manufacturing per year = 95.04 x 3000
= **2,85,115/-**
Shearing cost of scrap / stroke = 8/-
Number of strokes required per b = 4
Shearing cost per part = 4 x 8 = **32 /-**
Annual shearing cost for blank of new part Plate step 'A' = 32 x 3000
= **96000/-**
Total savings by scrap utilization per annum = Savings cost of grade change per annum – Annual shearing cost for blank of new part Plate step 'A'
= 285115 – 96000
= **1,89,115/-**

5. Conclusion & Discussion

5.1 Conclusions of the Work

This paper is based on analysis and finding various opportunities, where any organization can reduce the unwanted cost. Following are the conclusions:

(I) The paper is based on cost reduction techniques at supplier end for reduce overall cost of the final product & also contributes to improve in value of the product. The study is conducted in press shop of an automotive stamping part supplier unit, to check the scope in scrap utilization on the concept **Kaizen,** studied during this project. During the study, there are 300 types of press parts manufacturing in press shop as per bill of material (BOM).

Measurement and comparison of scrap dimension of a press part with other part of same or other grade depending up on the fitment and location in vehicle. According to tool trial result Outer Panel Fender's scrap can produce another blank for Plate step 'A' HCV. Total cost can be save per annum is Scrap utilization is **Rs 1,89,115/-**

5.2 Limitation of Study

The study is based on standard value which are set by company on their past experience and analysis. There are many factors like, working environment, operator skill, manpower efficiency, machine performance and other miscellaneous factors are not considered. Cost reduction technique may vary for purpose of study, product, process, geometry, weight and material grade and fitment in vehicle.

This study excludes production losses because of low production dies, which have complex geometries and also cause accidents of operator during work.

The concept is checked during tool trials and final part is compared by the standard part, so if all parameters are ok during trial then only consider. This method is based on ideas comes in the mind during work in production. There are some thumb rules, which can affect the results on the others parts.

5.3 Scope for Future Work

- This study is a specific study restricted to the case organization .A number of such studies can be done in variety of industries to reach at common conclusions, which can be generalist in nature.
- The interview sessions are conducted with different personnels to find out the cost reduction techniques which are used at their organizations. There are some more techniques, which can be used in the case organization like technical surveys, weighted score method, decision matrix etc.
- This study is conducted at the scale of middle level organization. It can be scale down at small scale industries and scale up for large scale industries.
- In this work, five interview sessions are conducted. The sample size can be increased up to 10, 15, 20, 30, 40 up to 50 for taking different opinions about cost reduction techniques.

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