

# Study and Analysis of Cost Reduction Techniques in Press Part Production: A Case Study of Stamping Unit

Anuroop Athalye<sup>1</sup>, Pankaj Gera<sup>2</sup>, Dr. A.R. Madan<sup>3</sup>

<sup>1</sup>Department of Mechanical Engineering, MITS, Ujjain (M.P.), India

<sup>2</sup>Associate Professor, Mechanical Engineering, MITS, Ujjain (M.P.), India

<sup>3</sup>Workshop Superintendent, Ujjain Engineering College, Ujjain (M.P.), India

**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 productivity improvement has also been studied. The outcomes have been analyzed and discussed in details.*

**Keywords:** Cost reduction, productivity improvement, lean manufacturing, 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

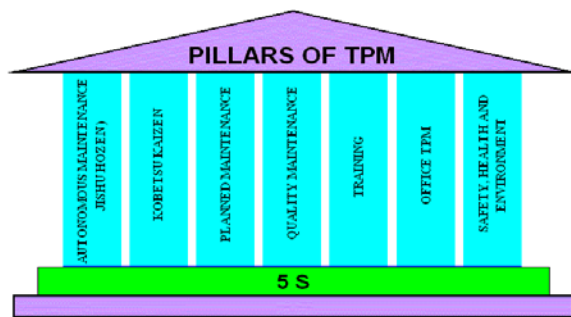


Figure 2.1: Pillars of TPM

### 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 more 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 organisations 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 600 Tonne press machine productivity improvement. 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 identify the scope in productivity improvement in 600T mechanical press. 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: - For 600T machine the improvement of productivity is depends on reducing number of dies change, improve production strokes per minute SPM and improve overall equipment efficiency (OEE) for which the press part reinforcement cab stay is production process is examine under the scheduled tool trial. The results of tool trial and quality check are noted. Calculation of total cost saving during productivity improvement.

**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.

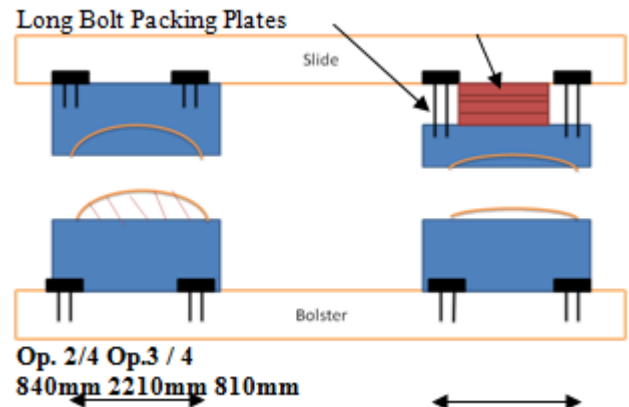
**A – Act:** Standardize the process  
 How it is done: - Document the results and prepare the presentation for management approval.

**3.5 Problem Identification:**

The press machine is in genral each stroke doing a single operation of particular part, so if combinning two single action dies in single stroke by loading in press machine simultaneously under safe working, will increase productivity by saving production time and operation cost.

After seen all the operation standards the part which selected is R/F Cab stay’s blank of size 1.2x270x405 mm<sup>3</sup> needs four operations one by one at 600 T m/c at least as per standards. The weight and dimension of dies are suitable to hold in 600T press machine. The operation 3/ 4 die is having less height than operation 2/4. So the idea is generated to hold the die the packing plate with the help of long bolts during trial.

The scheduled is planed by the production planning team. By this technique we will save the production time and production cost of one operation. The annual requirement for the vehicle part is multiplied by this above savings. After tool trials of a single lot 1000 parts 8 parts were rejected due to misfeed. The production rate, safety, quality and machine capabilities were checked during trial. Further the trial report is send to management for approval from costumer end. As per definition, the value of the product is increased.



**Figure 3.1:** Double Die Hold on 600T press during trial.

**4. Results & Analysis**

After applying the job plan for productivity improvement of 600 T mechanical press the R/F Cab stay LCV dies 2/4 and 3/4, the calculations are done on the basis of observations during trial.

**Table 4.1:** Operation Standard

Part name: Reinforcement cab stay lev				Op. std no. OPE/64/101			
Part no: IA207437				Customer Name: EML			
Operation no.	Operation	Press tonnage	Cushion press kg/cm <sup>2</sup>	No. of cushion pins	Cushion stroke (mm)	Balancer press kg/cm <sup>2</sup>	Press speed (spm)
4-Jan	Drawing	600T	1.5-3.0	6	112	3.5-5.5	17-Dec
4-Feb	Trimming	600T	-	-	-	3.5-5.5	15-25
4-Mar	Punching	600T	-	-	-	3.5-5.5	15-25
4-Apr	Cam piercing	400T	-	-	-	3.5-5.5	15-25

**4.1 Trial inspection report:** In this report the data is noted during tool trial.

**Table 4.1:** Production Parameter

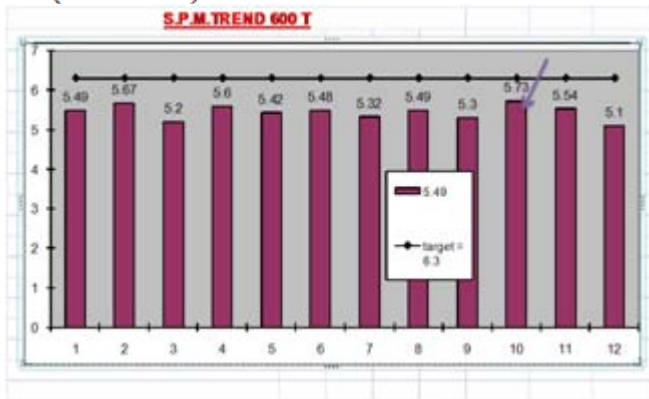
S/N	Part Name & No.	Lot size during trial	Per stroke cost of 600 T	Saving std. time during die change	Rejection with cause	Machine parameters check during trial	Any safety issue
	R/F Cab Stay	1000	Rs 8/-	10min	33 parts misfeed	No Hyd dump, Oil is on during Temp-ature 65° safety issue No extra noise and vibration found.	Photo guard trial so no safety issue



**Note: Per Stroke Cost** denoted here as “X” is calculated as per annual budget 2,61,27,360/- (Rs/Annum) } allotted for press shop, which contains all expenditures like Utility (crane, fork lifter, cooling tower, transportation, DG, compressors, Lights/lamps etc.), Salaries/ Wages (operators, helpers, fork lifter driver, line leaders, engineers, press shop In charge, Production managers etc.), Power consumption charges, Machine cost, General Maintenance, tool maintenance (tools, nut bolts, Housekeeping, miscellaneous charges like lockers, safety shoes, safety goggles, hand gloves, aprons, uniforms, ear plug, stationary etc.)

$$\text{“X” (Rs/stroke)} = \frac{\text{Budget in Rs/min}}{\text{Target Stroke per min of the press}}$$

$$= \frac{50.4 \text{ (Rs/min)}}{6.3 \text{ (Strokes/min)}} = 8/- \text{ (Rs/stroke)}$$



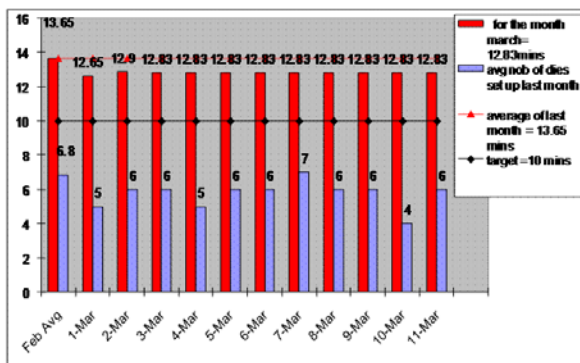
**Figure 4.1:** SPM trend refers to the number strokes per minute by any press machine in total available time

**Description of figure 4.1**

Y axis shows strokes per minute of 600 T mechanical press  
 X axis shows no. of days  
 Target SPM 6.3  
 The maximum SPM at 10<sup>th</sup> day due to kaizen for productivity improvement  
 As per the daily production report the production trend for the day for all press machines in press shop for the day.

The following observations of 600T mechanical press are:

- i) Number strokes for two shifts are **4992**
- ii) Number of die set up **04**
- iii) Strokes per minute is **5.74**
- iv) O.E.E is **90.21**



**Figure 4.2:** Die changing time refers to the average time taken for total die change in a day on a press machine.

**Description of figure 4.3**

Y red bars shows time taken during die change & blue bars shows no. of die change.  
 X axis shows no. of days  
 Minimum die change on 10<sup>th</sup> day due to Kaizen for productivity improvement.  
 Target die change time is 10 min

**4.1.3 Calculations**

**Machine specifications**

Type: Pneumatic Press  
 Bolster size 1450 x 2210 mm<sup>2</sup>  
 Tonnage= 600T  
 Efficiency = 80%  
 Stroke length =2260mm  
 Shut height = 450mm  
 Die Specifications as per operation standard

**Operation 2/4 (Trimming)**

Die size =530 x 840 mm<sup>2</sup>  
 Height of die = 630mm  
 Manpower required = 04  
 Weight of Upper half of die =110.5 kgf  
 Approved Cost for operation at 600T = Rs 8/stroke

**Operation 3/4 (punching)**

Die size =560 x 810 mm<sup>2</sup>  
 Height of die = 610mm  
 No of packing plates required of thickness 5mm = 04  
 Weight of upper half of die after packing plates = 110.5kg  
 Manpower required = 04  
 Approved Cost for operation at 600T = Rs 8/stroke

**Procedure**

“Operation cost is indicated here as number as production strokes of the press machine”

- (A) Operation cost = approved per stroke cost x annual requirement of parts = 8 x 22000 = **1, 76,000/-**  
 Standard die change time is the time taken during removing of previous operation die and uploading next operation die on bolster.  
 Standard die changing time = 10 mins  
 Annual saving in standard die change time(SDCT) = (annual production/lot size)xSDCT  
 = (22000/1000)x10min = **220mins**  
 Standard SPM of 600T Machine = 6.3 strokes/min  
 Annual increment in production strokes as per standard SPM of 600T Machine = Annual savings in SDCT x Standard SPM of 600T Machine = 220x6.3 = 1386 production strokes
- (B) Annual improvement in production cost= productions strokes x standard costing of M/c = 1386x8 = **11088/-**  
 Total savings in VAVE = (A) + (B) = 176000+11088 = **187088/-**

**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:

- 1) 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 productivity improvement, scrap utilization on the concept of **lean manufacturing & 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).
- 2) There are following parameters of productivity improvement in 600T Mechanical Press

**Table 5.1: Data Findings**

SN	Factors	Findings	Previous
1	Strokes per minute SPM	5.74	5.67
2	Over all equipment efficiency OEE	90.21%	89.65% Average of month
3	No. of strokes	4992	4927 (Targeted for two working shifts)
4	Cost reduce per annum	187088/-	-

Dimensions, weight of die and tonnage requirement are selected from operation standard for productivity improvement. The part Reinforcement Cab stay LH/RH is having die is selecting for tool trial. After finding the ok part the die Operation no. 3/4 upper half is require to increase its height by **20mm**. The O.E.E. for the day FTD is **90.21%**, which is more than month till date MTD **89.65%**. The improved SPM (strokes per minute) of the **600 T** press machine for the day is **5.74** which is maximum SPM from last 09 days production. The die change is minimum for the day FTD is **04** and the no. of strokes for the day for two shifts are **4992**, which are higher than the target strokes per two shifts **4927**.

### 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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