Implementation Of Value Analysis Technique for Cost Reduction-Quality Preservation

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Abstract— In today's highly competitive marketplace, working better, smarter and delivering quality based products on time at more effective cost is crucial for all types of industries. This intensifies and enforces all the manufacturing industries to produce better quality products with least possible cost. Production of best Quality product with least possible cost can be possible by reducing the production of non-value adding attributes. A case study was carried out in one of the manufacturing industry. It has major applications in sheet metal working. During study, few non-value adding elements were observed and causes behind that were found out by using Value Analysis technique, cause & effect diagram and Pareto analysis. The limitations of this study are maintaining product within functional and aesthetic perfection, customer satisfaction, etc. It is concluded from the study that the part quality is lying within customer requirements, manufacturing processes and at lowest production cost with minimum wastage production.

Keywords: value analysis technique, cause and effect diagram, Pareto chart, Project performance comparison.

I. INTRODUCTION

Value Analysis is a process of systematic review that is applied to existing product's design and its manufacturing process in order to compare the function of the product required by a customer to meet their requirements at the lowest cost consistent with the specified performance and reliability needed. It also analyses the product and its outcomes during manufacturing process. Its aim is to reduce manufacturing cost and time by reducing non-value adding elements. There are two types of non-value adding elements i.e. Direct and Indirect. Direct is nothing but waste produced during part production. Indirect is the rejection, includes rejection due to some defects i.e. crack, wrinkle, dents, surface scratches and other damages. Quality is nothing but satisfying customer needs and expectations either meets or exceeds their requirements. Value Analysis technique is used for this study, as it is useful to identify root causes of the problem and also useful for understanding and analysis part's importance, evaluating solutions and their implementation. This technique includes number of stages such as Starting phase, data collection, observation, analysis, discussion, solution finalization, development, Implementation, control, etc.

II. LITERATURE REVIEW

The application of the 5-whys analysis in a manufacturing industry provides a fact-based and structured approach to problem identification and correction that not only reduces, but also totally eliminates defects. The Toyota Production System's 5-whys analysis is performed to analyze the cause of wastages, to formulate and implement corrective actions [1]. For an organization, which strives to be extremely efficient in its endeavor to satisfy its production requirement, the consequence of having highly efficient time could not be understated. Performance of an organization is determined by the capability of its processes. High quality processes deliver high quality products, at the lowest possible cost and on time. By making certain minor changes in the existing process it can yield great benefits in terms of money. Specifically, the process of finding out loopholes of the process and reducing the scrap generated in the process and thereby improving the productivity index and performance of the process is very sophisticated task. Without techniques like cause & effect diagram, pareto analysis and actions taken towards the attainment of the final goal, any initiative would be a failure[2][3]. The layout which optimizes material utilization without considering the defects on the sheet may actually lead to a larger number of rejections and hence greater total wastage. A balanced layout optimized both for minimum rejections and maximum utilization, may lead to significant raw material, and hence cost saving [4]. DMAIC approach helped successful completion of the study with clearly defining study road map. The study brought out the importance of data collection of scrap by the quality team and importance of defining the scrap in terms of quality. The study was successful with 88% reduction in total scrap cost. Cost saving through the study is estimated as Rs.23. 27 lakhs p.a. It is concluded from the study that any complicated problem can be solved by systematic application of DMAIC approach [5]. No Company can take seriously Total Quality Management without operating a formalized system of Value Analysis (VA). No business that wishes to become lean will ever succeed if product designs remain unchanged because no amount of continuous improvement in the manufacturing process can release the costs of a poor design or a design that has not changed for many years. However, poor product reviews or an informal process, that is restricted to only to a review of the design by the design department, will yield only limited success in eliminating avoidable costs. These efforts will miss the many opportunities to make manufacturing and assembly easier, quicker, less complex and less costly. Thus margins will not be improved significantly because only a small part of the total process has been managed correctly. As such, this type of superficial activity will not generate increased profit and the revenue stream that will be needed to finance new products and new investments in technology. A properly managed and effective Value Analysis (VA) process will easily repay the time invested by managers over the life of the product and a truly effective process will yield significant competitive advantage for companies that exploit it. For businesses that supply other organizations, the ability to design and redesign products opens the possibility of true, meaningful, profitable and long-term partnership with a customer. Each progressive step that secures a greater design responsibility for the supplier will, in parallel, make the supplier increasingly more important to the competitive

advantage of the customer organization and will increase the benefits to both companies. [7]

III. CASE STUDY

In sheet metal working, during cutting operation of adjacent parts some space is required in order to accommodate the form factor, which may be considered as a waste (shown in fig.1 in gray color).

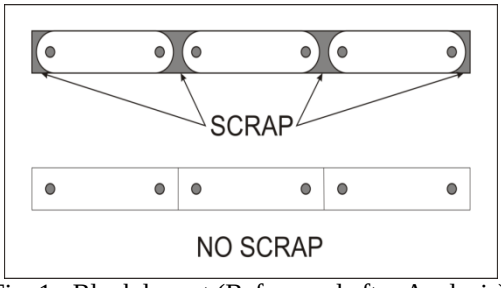

Fig. 1: Blank layout (Before and after Analysis)

In above Fig, a metal strip originally has curved edges. While this is a good idea from safety point. If the part is exposed, the design adds additional cost, both in the manufacturing process and in scrap. The original design created a need for space between adjacent pieces, so that the metal stamping process could be utilized. Ideally, parts should be designed, so that the edge of one is also the edge of the next part. That cuts scrap between the two parts to zero. In the redesigned part a shear was used to eliminating scrap. So, more parts were able to be produced from a single blank with reduction in tooling cost for the curved end. For complicated parts more material is provided than needed, simply because of, it is easier to design part in that way. However, a simple redesign, removing excess material, can reduce production costs by reducing scrap.

IV. PROBLEM STATEMENT

The non-value adding elements are nothing but waste creating elements. Reduction in non-value adding elements means reduction in production cost, manufacturing time and increase in productivity. The study was focused on eliminating such non-value adding elements. During this study, Some waste creating elements were observed during some part's production. So, the study was carried out to eliminate these non-value adding elements by using value analysis method.

V. METHODOLOGY

The methodology consists of analysis of sheet metal part by usin different stages involved in value analysis technique as given below,

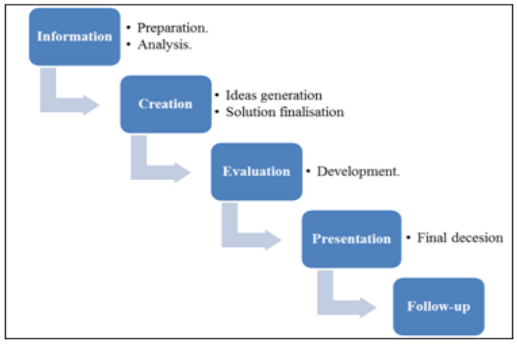

Fig. 2: Steps in Value Analyses

In information phase, the current data associated with part production was collected, then that data was checked and confirmed during part production in next phase. After both the phases all data were analyzed and possible solutions for improvement were generated. These possible solutions were evaluated for different improvement factors and in development phase few solutions were finalized. After that this few solutions were listed out and presented in front of management for getting final approval. For this systematic method the cause and effect diagram, Pareto chart are used. The part, on which this study was focused, is made up of sheet metal. The part is having more importance in fitment. So maintaining part quality was our primary goal than other factors.

The analysis work based data collection and observation aiming to cost saving and removal of non-value adding elements was carried out on sheet metal part. Part specifications are as given in Table I ans Fig.3.

Table I- Part Details

Particular	**Details**
Part Name	Supporting Pillar
Blank shape	Trapezoidal
Material	Mild steel
Blank Length	Major length 970 mm and minor length 430 mm.
Blank Thickness	0.7 mm
Blank height	1320 mm (Initial)

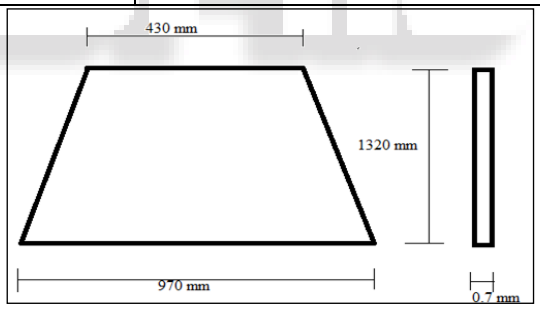

Fig. 3: Blank Shape

The five different types operations are involved in this part's production such as blanking, forming, side Trimming, Flanging and final seperating i.e. cutting operation. The part production quantity per year is 25000. The part was analysed to minimise production of non-value adding elements related with its production. So the analysis work was started on part's dimensions, design and manufacturing process aiming to findout causes for waste.

A. CAUSE AND EFFECT DIAGRAM

The different responsible factors for the problem were divided into four main categories i.e. 4M as shown in Fig.4,

- Man power - Skill, experience, capacity, attension towards process, etc.
- Machine - accuracy, maintenance, operations, lifecycle, etc.
- Material - dimension, property, waste, etc.
- Method - handling, process flow, suitability, etc.

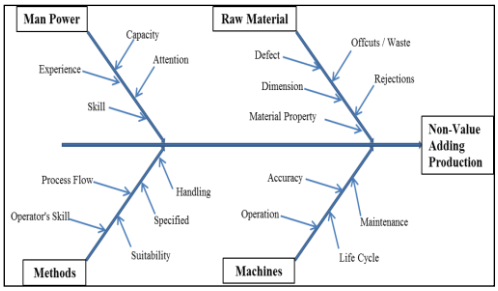

Fig. 4: Cause and Effect Diagram

B. PARETO CHART

It is a tool that shows contribution of affecting factors in cost saving and also in improvement. It clearly indicates where to put initial efforts to get the maximum saving and improvement. The four factors were listed out which are responsible for production of waste as blank dimension, rejection (scrap) during part production, machine maintenance and man power capacity. The contribution of listed factors are given in Pareto chart as shown in Fig.5

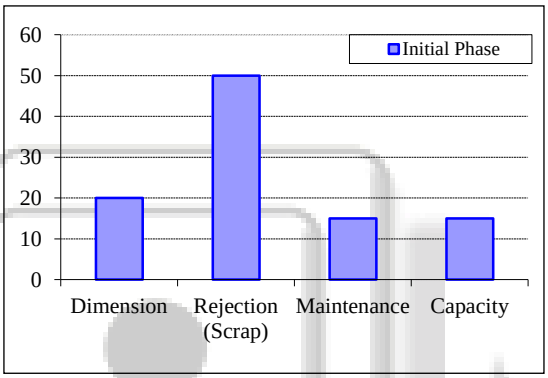

Fig.5- Pareto Chart

The following conclusions were come out from analysis work. In dimension, the height of raw material (blank) for supporting pillar part was 1320 mm and that of final part is 1310 mm. This size includes an extra material of 10 mm. But after analysis, it was observed that only 3mm is adequate for part's production. So after analysis the height of part is reduced from 1320 mm to 1313 mm. In rejection, the 7 mm size material was extra material which was contributing more in waste production. In maintenance, the regular machine and process maintenance was also observed as an affetcting factor and lastly Man power is also the affecting factor in material handling i.e. in loading and unloading of material.

VI. RESULTS

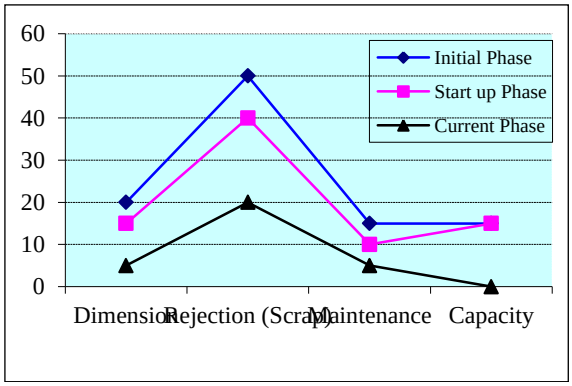

Fig. 6: Project performance comparison

The study is successful and results in to the reduction in production cost per part. The implementation suggested improvements in four affecting factors was completed and following conclusions were concluded.

The cost related with wastage was 3 rupees per part. The aim of study was to reduce this cost. The study results in to reduction of wastage cost by 2 rupees per part and remaining cost of 1 rupee is nothing but non-value adding cost but beneficial from safety point. The annual part production quantity is 25000 and annual cost saving from this part is approximate 50,000 rupees.

The above graph clearly shows the difference between three stages involved in project implementation i.e. initial phase of part production (Blue Line) which shows the contribution of four factors responsible for wastage production. At the starting phase of project implementation (Pink Line) few beneficial results were achieved from improvements and after project implementation i.e. current phase (Black Line) shows results were achieved as per requirements. The graph shows that, there is continual improvement in all the affecting factors.

VII. CONCLUSION AND FUTURE SCOPE

The study is successfully implemented with reduction in non-value adding element's cost. So, the annual cost saving from these parts is approximate 1 lakh rupees. It is concluded from the study that, produced part quality is lying within the manufacturing processes and required quality. Also, any complicated problem can be solved by systematic application of Value Analysis techniques. The industries have to focus on continual improvement to get better benefits in the future which helps to contribute in organization's improvement. Benefits such as,

- Reduction in non-value adding elements.
- Modifying designs to reduce scrap.
- Reduction in product cost, without compromising quality

REFERENCES

[1] Uthiyakumar Murugaiah, Samuel Jebaraj Benjamin, M. Srikamaladevi Marathamuthu, Saravanan Muthaiyah, (2010) "Scrap Loss Reduction Using The 5-Whys Analysis", International Journal Of Quality & Reliability Management, Vol. 27 Iss: 5, Pp.527 – 540.

[2] Sanjay Kumar, Dr. S.S. Mantha and Dr. Arun Kumar, "Scrap Reduction By Using Total Quality Management Tools". International Journal of Industrial Engineering, 16(4), 364-369 2009.

[3] Dale H. Bester Field Et. Al, "Total Quality Management," Second Edition, Person Education Asia, 2001

[4] Mohd Hilman Bin Sobhi, "Scrap Reduction Study for Automotive Stamping", Universiti Malaysia Pahang, Chapter 2.

[5] Afzal Matathil, Ganapathi K. N., Kalathil Ramachandran, "Reduction Of Scrap In An Electronic Assembly Line Using Dmaic Approach", Volume 11, Issue 2, Sep 2012

[6] http://ct.componenteng.com/blog/bid/193934/ Reduce-Metal-Stamping-Costs-by-Limiting-Scrap

[7] Nick Rich, BSc MBA Matthias Holweg, Dipl. Wirtschaftsing. (FH) MSc, Lean Enterprise Research Centre Cardiff, United Kingdom JANUARY 2000.

