

Improvement in Manufacturing of Pedal Shaft by the Application of Six Sigma

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Abstract— In many multinational and national companies throughout the global market applying six sigma processes. The six sigma in present day is widely accepted methodology of process improvement. The implementation of six sigma always approach for the defect free production almost zero defect per million of products, however in practice its it is less possible .the little increment in present sigma level would increase the profit margin of the company dramatically. This paper mainly focus on application of DMAIC methodology and the various tools of DMAIC for the rework reduction of pedal shaft (model no 242) of EICHER TRACTOR. Pedal shaft (242 model no.)Is unit of breaking system a little error in production cause rework ultimately loss of time and money.

Key words: DMAIC, DMADV, VA, NVA, DPMO

I. INTRODUCTION

In 1986, the engineer bill smith while working in Motorola successfully employed the six sigma, Motorola became the quality leader because they won the Malcolm Baldrige national quality in 1988[1].the companies like Motorola , GE ,Larson and turbo, etc are using the six sigma techniques for the business excellence and quality improvement and for the customer satisfaction. The study of project leads to the findings of value added (NV)and non value added (NVA) resulting the elimination of non value added process reduction in waste , cost and time saving ,elimination of NVA increase the profitability of the products and process. There are five integrated process of DMAIC methodology are, define, measure, analyse, improve and control where each phase have a tools to apply. The various phases of DMADV are, define, measure, analyse, design, verify. This methodology is applied for the products which are to be newly manufactured and process will perform at six sigma level .however the DMAIC methodology is applied for the existing processes for continual improvement, finding the variation in process, and correcting it to the

II. LITERATURE REVIEW

1) Prof. S.N. PATIL, Mr. A.A. Mehatkar, Mr. K. R. Shinde have presented the paper on the “Rejection reduction in manufacturing of automobile clutch pedal using six sigma “ authors have proposed the main causes of failure of the clutch pedal. The authors shown the flatness of the die surface was uneven and this was the main cause of failure, height of the die get shifted, the authors studied TPM check sheets the check sheets was ok the problem found in flatness ,cushion pin height, shut height, press tonnage ,Bottoming of tool was not proper, in improve phase the authors suggested

solutions[1] the flatness variation should be made zero by micromachining operations [2] blunt edges of locating and guidlining portions or surface should be removed .

- 2) Sandeep B. Jadhav, Ganesh P. Jadhav, proff. S.N. Teli has presented the article “Steel industries and six sigma” in this the focus of author was on the energy consumption acquired by steel industries and other industries,. The authors have presented the sectorial energy consumption (pie chart) as a review of energy consumption in various sectors such as textile, aluminium, paper pulp, tobacco and food, cement, chemicals, iron and steel, other .where the 37% of the total energy was consumed. The author has proposed the challenges in implementation of six sigma.
- 3) A.Raghunath, Dr.R.V.Jayathirtha presented the paper "assessment of current status of adoption of six sigma by auto component sector "this literature review conduct idea about benefits of implementing the six sigma methodology over the auto component manufacturing, the process came down to the negligible level and improvements in production.
- 4) A. Raghunath, Dr.R.V. Jayathirtha in their paper "critical success factors for six sigma implementation by SME,s" explains the factors affecting in the medium sized industry for the application of six sigma method. The authors also suggested the needs for six sigma approach, myths of six acceptable level. In 1 million products only 3.4 parts are defective while rest of the 999,996.6 parts are non defective which is nearly equal to “zero defect“ with success rate of the 99.999660% the Greek letter sigma stands for the variations the sigma concept was originated from the normality distribution curve.
- 5) Sigma, criteria for the six sigma project selection, six sigma implementation, author shown the six sigma can be applied for the medium, small, large scale industry.
- 6) Dr. Rajeshkumar U. Sambhe in their case study “six sigma practice for quality improvement, a case study of Indian auto ancillary unit “India is 4th largest market for tractors and the author have discussed about the DMAIC methodology.
- 7) Nayan J. Prajapati, Darshak A.Desai collected "A review of six sigma implementation at exporting industries “the author has collected the application of DMAIC in exporting industries. the six sigma is also applied for the service sector the growth of the export industries can lead to economic balance of their country, tremendous competition in export industries can lead to the creation of much better quality in a global market.

- 8) N. Venkatesh, C. Sumangala, Laney D`souza presented the paper on the "outcome of six sigma implementation a case study of manufacturing industry "the authors made an attempt to investigate the effects of six sigma implementation, whether it has contributed to improvement in growth of the organization in regards their financial benefits ,equity, product, and quality .the author have conducted the study on view of 26people form these 26people, 16were worker's and rest 10were from the managerial level, they found that the applied methodology has contributed successfully in terms of growth of company. The collected data was analyzed with SPSS V16 software.
- 9) Justin E. Faust "increase efficiency using six sigma methodology" this paper have collected the flow chart of the painting process also focus the customer requirements, the author have collected the x-bar chart plotted average against the sample number and discussed about the operational, equipment issue.
- 10) Saad A. Sheikh, Javed Kazi presented the article "Review on six sigma (DMAIC Methodology). In this paper the author shown the generalise idea about the application of DMAIC, DFSS, methodology.
- 11) Behnam Nakai, "The challenges of six sigma in improving service quality" in this paper the author have discussed about the costumer expectation, study was based on service quality of health care industry. the quality evaluation of the any product is far easy than the evaluation of any service quality. the service quality is directly related with costumer expectation and requirements, author also discussed about the other challenges in service quality improvement.
- 12) James J. Scutti, William J. McBrine "Introduction to failure analysis and prevention" the author have discussed the root cause of the problem and their elimination.

III. INDUSTRY BACKGROUND

Shree industry is the manufacturing industry and the only one vendor of the EICHER tractor supply the pedal shafts. the industry is located in 156/1 midc, hingna, nagpur-4400016. Manufacturers of the pedal shaft 241,242, southwest. It is a medium scale industry uses 4cnc machines and having 30Labour in industry and has 2 shifts. The industry have already gone through the DFSS, and now they are willing to apply DMAIC methodology for the process improvement

Monthly production: 242 model 800 to1200 per Month.

IV. REWORK CALCULATIONS

The paper focus on the rework reduction the major problem is dimensional errors due to these the component are sent for the rework base upon the data collected of the 50product pedal shaft model 242.out of 50 product 11 product are sent for the rework. the current DPMO is found to be 220000 and the sigma level is calculated is 2.8 the calculated sigma level is merely based on 50 random inspection

Defect per unit=no of defect/no of product inspected =11/50 =0.22

$$DPMO = \text{defect per unit} * 10,00,000 = 0.22 * 1000000 = 220000$$

(In EXCEL)

$$\text{Sigma level} = \text{normsinV}(1 - (DPMO/1000000) + 1.5) = \text{normsinV}(1 - (220000/1000000) + 1.5) = 2.28$$

V. METHODOLOGY

Reduction of defects upto 3.4is the less possible task. Six sigma uses the DMAIC,DMADV, methodology which is the closed loop process uses the special tools for each phase. DMADV includesdefine,measure,analyse,design, verify, DMAIC phases are define, measure, analyse, improve, control.

A. Define

This phase determine the objective and goals of the study. reducing the rework caused by the dimensional errors, the operator have to maintain the lenght and diameter ratio 13.133mms,where the lenght is 394mms and diameter is 30mm, it is important to maintain the ratio.

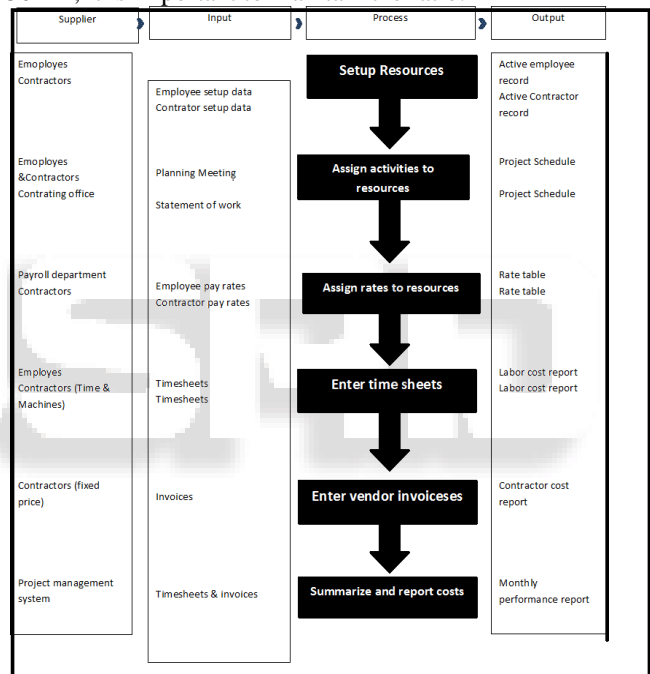


Fig. 1: SIPOC Diagram

B. Measure

In the measure phase the problems associated with process is measured. And value added, and non value added time is calculated. it is found that rework is non value added.

Sr. no.	Name of operation	Time in second	VA/NVA
1.	First setup time	120	VA
2.	Second setup time	540	VA
3.	Bar cutting operation	180	VA
4.	Hobbing	600	VA
5.	Drilling operation (long drill)	540	VA
6.	Welding operation	900	VA
7.	Drilling and chamfering	360	VA
8.	Tapping	240	VA
9.	Rework	600	NVA

Table 1: Measurements

C. Analyse

This phase used to analyse the data and process and finds the root cause of the problem and opportunities. The following fish bone diagram explains the problem occurring with the pedal shaft 242 model.

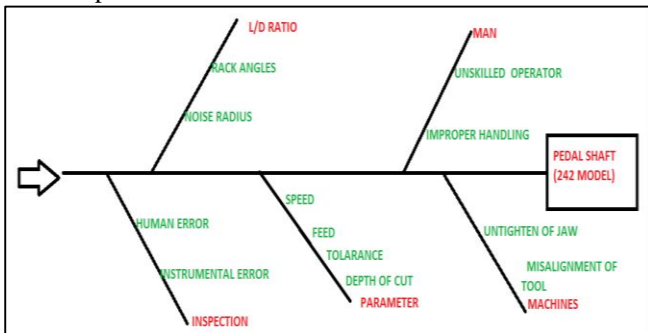


Fig. 2: Analyse the Data and Process

D. Improve

In this phase we are applying six sigma for the improvement of process in the manufacturing for pedal shaft.

E. Control

To control the rework we are trying to use the different control charts and plans. we are finding the does and don'ts for the reduction of rework.

VI. CONCLUSION

Depending upon the present work we have are expecting that the rework will get reduced to almost negligible level and production rate will increase up to three times in future, and we are applying all tools and techniques of six sigma to increase the present sigma level.

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