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Paper Authors

BALOJI BADAVATH, DR. M. INDIRA RANI

JNTUH College of Engineering, Hyderabad (Autonomous)

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ENHANCEMENT OF WELDING PROCESS FOR A FIXTURE DESIGN USING SIX SIGMA PROCESS - A CASE STUDY

[1]BALOJI BADAVATH, [2]DR. M. INDIRA RANI
[1]Research Scholar Mechanical Engineering, JNTUH College of Engineering, Hyderabad (Autonomous)
[2]Professor,Mechanical Engineering, JNTUH College of Engineering, Hyderabad (Autonomous)
[1]baloji3064@gmail.com marpuindira@gmail.com

Abstract:
Six sigma has been implemented all over the World as a successful Quality Improvement Methodology. This article provides a description of Six Sigma Project implemented at Local manufacturing Company. Initiated in the automotive industry, continuous implemented to improve the manufacturing process change. SS elaborate a case where lean process. This paper deals with the design and fabrication of MIG welding fixtures. The objective of this thesis is to develop welding fixtures that able to clamp work piece and reduce the rejection ratio in production. Clamping design and common welding jigs material was studied in order to design and generate concept for the MIG welding jigs. Solid Works was used to design or draw the final concept of the MIG welding jigs. On the other hand, screw clamp was used to design clamping system for the welding jigs. This study deals with Six Sigma DMAIC methodology implementation and gives a frame work of how the non-conformance rate was first monitored and then brought in to acceptance limits.
Keywords: Welding distortion, MIG welding, Six Sigma, Variable control chart

1.0 Introduction:

The roots of Six Sigma as a measurement standard can be traced back to Carl Frederick Gauss who introduced the concept of the normal curve. Six Sigma as a measurement standard in product variation can be traced back to the 1920′s when Walter Stewart showed that three standard deviations from the process mean is the point where a process requires correction. Later came on the scene but credit for coining the term "Six Sigma" goes to a Motorola engineer named Bill Smith. (Incidentally, "Six Sigma" is a federally registered trademark of Motorola). Motorola developed this new standard and created the methodology and needed cultural change associated with it.

Since then, hundreds of companies around the world have adopted Six Sigma as a way of doing business. Two sources were used to collect the primary data. First, wastes identification was implemented through a brainstorming session with some managers to answer seven wastes questions. The illustration and analysis are based on literature review and the answers of the brainstorming groups. Second, a questionnaire was distributed to the management of all of the manufacturing division having more than some employee, and member of the research team offloaded and analyzed the results and resolution through the use of the statistical procedure. The data collection in this study involves quantitative and qualitative methods. Using this approach, information can be generated from the practical issues in implementation of lean six-sigma

Objectives:

- History of Six Sigma
- Describe the Six Sigma Philosophy
- Proactive approach to designing and monitoring key activities

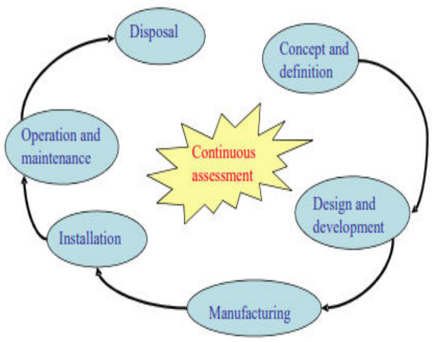
Six Sigma Background:

• Motorola employee investigating variation in various processes

• Acted on results using tools to reduce variation

• Improved the effectiveness and efficiency of the processes

Product life cycle:



Design for Six Sigma

It is the set of practices originally developed by Motorola to systematically improve process by eliminating defects. Defect is defined as non-conformity of a product or service to its specification. Like its previous quality improving methodologies six sigma focuses on the following points. • A continuous effort to reduce variation in process outputs is essential to business success.

• Manufacturing and business processes can be Measured, Analyzed, Improved and Controlled. • In order to achieve best Quality Improvement results, role of upper management is very critical.

2.0 Literature review:

Six-Sigma is a systematic approach for improving manufacturing or service processes. Strengthen of six-sigma lies in its framework to facilitate the application of tools and techniques in a build data driven to support decision making [1-3]. The application of six sigma was predominant in manufacturing process improvement. Recent developments show that its application is increasing in non-manufacturing operations such as transactional processes [4]. In order to apply six-sigma more broadly, need to introduce nonmanufacturing that also involve processes. Identification of process parameters is one of the key to implementation of six-sigma in nonmanufacturing or service [5-8]. The success of six-sigma depends on certain success factors such as, top management commitment; tools and techniques; application of six-sigma methodology in DMAIC; and identification of KPIs such as financial impact measurement [9, 10]. Meanwhile, the statistical aspects of six-sigma must complement business perspective and challenges to the organization to implement six-sigma. Various approaches to six-sigma have been applied to increase the performance of different business sector. Integrating data and six-sigma processes in to organization still has room for improvement. Culture changes require time and strongly commitment before implanted into the organization [11]. Effective six-sigma principles and practices will more succeed by refining the organizational culture continuously. Six-sigma is a business improvement approach that seeking to find and eliminate causes of defects or mistakes in business processes by focusing on process output which

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critical in the eyes of customers. Six-sigma principles can be used to shifts the process average, help to create robust product and process and reduce excessive variation in process which lead to poor quality. The term of sigma is a measure indicating the deviation in the performance characteristic from its mean performance. The basic goal of a six-sigma strategy is to reduce variation of performance characteristic. In order to improve the quality, it is imperative to measure or quality variation and then developed potential strategies to reduce variation. There are many literatures available on tools and techniques used in sig-sigma. Tools are mostly having a clearly defined role but narrow in focus, whereas techniques have wider application and require training, creativity and specific skill [12]. Some other literature provide classification scheme for tools and techniques used.

3.0 Methodology:

Six-Sigma Principles and Business Strategy:

- Project management
- Data-based decision making
- Knowledge discovery
- Process control planning
- Data collection tools and techniques
- Variability reduction
- Belt system
- Change management tools

Six-Sigma Techniques and Tools:

- Statistical process control
- Process capability analysis
- Measurement system analysis
- Design of experiment
- Robust design
- Quality function deployment
- Analysis of means and variances, hypothesis testing, roots cause analysis, process mapping

The Six Sigma project team needs to come out with an explicit list of vital inputs, desired outputs and process metrics that they are planning to track. This decision has large scale implications on the performance of the project and is usually taken by the Project Leader on the basis of data provided by the Six Sigma team and the Process Owner.

There have been many cases of measurement bias in Six Sigma history. The bias may have its roots in the complexity of the calculation, the wrong method of data collection or the bias of the person performing the exercise.

Calculating the Current Sigma Levels:

A common practice in the measure phase is to put a figure in front of the losses that the organization is currently facing due to inefficient processes. This helps the management to evaluate the process and the Six Sigma team can bargain for more resources to successfully implement the project.

Current Base line for the Process:

Mean of cylinder inner diameter = 50.4512mm

Standard deviation = 0.0708445mm

Upper specification limit = 50.6 mm

Lower specification limit = 50.4 mm

Cumulative distribution:

Function of sample taken Normal with mean =50.4512mm and standard deviation = 0.0708445mm.

Cumulative Distribution Function x P(X<=x) 50.4 0.234929 50.6 0.982152

Inverse Cumulative Distribution functions:

Normal with mean = 0 and standard deviation = 1

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4.0 Results and discussions:

A case study is presented and taken where systematically the control process of manufacturing will be improved by applying of lean six joined and eliminated by reduction the down time

Tables shows the Sigma value

Period	Production (Unit)	Defect (Unit)	DPMO	Sigma value
1	70007	2182	15584	3.7
2	58544	1668	14246	3.7
3	119081	3900	16375	3.6

The third waste is waiting waste. Waiting waste is a certain amount of time when operator does not use the time to perform value added activities due to waiting for flow of products from the previous process. The indication of waiting on the production process is stated by downtime caused by the machine breakdown. Machine downtime is influenced by several factor such as cleaning, waiting for the material, change tools, the machine is done setting, power failure, maintenance and broken machine.

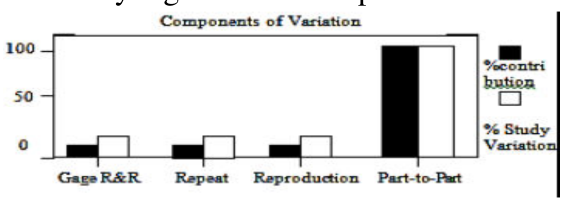
Alternatives solution

Sub Waste	Effect	Root Cause	Improvement
Breakdown Machine	Power Failure	Less Electrical Power	Raise The Power
Rivet Defective	Operator Error	Operators Are Not Careful	Improvement of Inspection
	Hole Processing Errors	Limited Number f Jig Fixture	The Addition of Jig Fixture
Body Defective	The Body Scratched	There Are No A Protective	Provide A Protective Layer

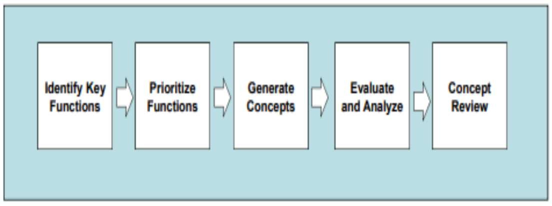
Gage Linearity Analysis

Predictor	Coefficient	SE Coefficient	P
Constant	0.01434	0.01442	0.324
Slope	0.0000145	0.0001223	0.906
S	0.070711	R-sq	0.0%
Linearity	0.0000051	%Linearity	0.0%

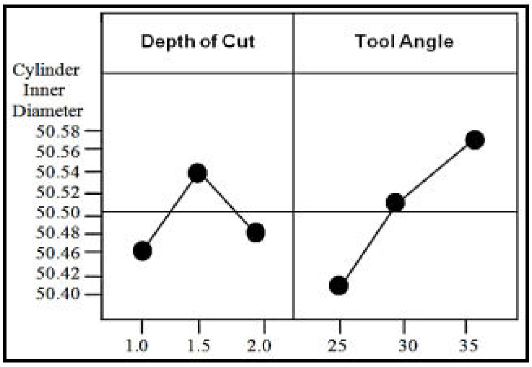
Above Table provides enough evidence that bias of the instrument is constant over its measuring range and the gage measures constantly regardless of the part size.



Gage R&R for Measurement



Analyze the factors



Main Effect Plots for Cylinder Inner Diameter

Local pump casing manufacturing facility was receiving high defect rate due to which quality of the production lots was being effected and customer complaints had to be addressed. This was turning in to high financial loses to the company. An effective quality improvement technique called Six Sigma was decided to be implemented in the facility.

At this stage the defect rate was 25.27% with sigma capability of 2.16. Pareto charts defined that chamber inner diameter defects were more than 71.4% of the total defects and was potential KPIV to be addressed. Further analyses cleared that depth of cut; feed rate and tool angle were contributing in defect rate. After carrying out detailed analysis of the process, tool settings came out as main reason for this defect rate.

Feed rate had not significant effect as compared to depth of cut and tool angle.

Best results were achieved at:

- Feed rate = 8mm/min
- Depth of cut = 1.5 mm
- Tool angle = 30 degrees

5.0 CONCLUSION:

Implementation in six-sigma have been proved and success in the last few years. It is becoming a main driving force for technology driven and project driven. Factors influencing successful lean six-sigma projects include management involvement and organization commitment, project management and control skill, continuous training, and culture change. Tracing some of shortcomings, key indicators and weakness of six-sigma gives opportunities for implement lean six-sigma project. It allows better support for strategic and direction, and improving needs for mentoring, training and coaching. Contributing to the development of a lean six-sigma conceptual framework, where the main objective of six-sigma is reducing variation and that of lean is reducing cycle time.

Six-sigma has been proved as structured methodology to improve organizational processes. With focus on customer and systematically translate critical to quality characteristics into improvement project so the success of the organization will be realized. It can be said that six-sigma programs enable organization to become more creative through dual focus on efficiency and continuous improvement. In addition, as firms that take advantage on lean six-sigma programs, monitoring, ability in identifying, and finding the needs of future customers maybe dreadfully required.

References:

[1] Antony, J. Six-sigma for Service Processes. Business Process Management Journal, 12 (2), 2006, pp. 234-248.

[2] Antony, J. and Banuelas, C. R. Key Ingredients for the Effective Implementation of Six Sigma Program. Measuring Business Excellence, 6 (4), 2002, 20-27.

[3] Henderson, K. H. and Evans, J.R. Successful Implementation of Six-Sigma: Benchmarking General Electric Company, Benchmarking. An International Journal, 7 (4), 2000, pp. 260-281.

[4] Basu, R. Implementing Quality: A Practical Guide to Tools and Techniques: Enabling the Power of Operational Excellence. London: Thomson Learning, 2004.

[5] Anbari, F. T. Six-sigma Methods and Its Applications in Project Management. Proceeding of the Project Management Institute Annual Seminar and Symposium, San Antonio, Texas, 2002

[6] Harry, M. J. and Schroeder, R. Six-sigma: The Breakthrough Strategy Revolutionizing the World's Top Corporation. New York: Doubleday, 2000.

[7] Hoerl, R. W. Six-Sigma Black Belts: What Do They Need to Know? Journal of Quality Technology, 33 (4), 2001, pp. 391-406.

[8] Jones Jr., M. H. Six-Sigma: At a Bank. ASQ Six-Sigma Forum Magazine, Vol. 3 No. 2, 2004, pp. 13-17.

[9] Young, J. Driving Performance Results as American Express. Six-sigma Forum Magazine. Vol. 1 No. 1, 2001, pp. 1-10.

[10] Rucker, R. Citibank Increases Customer Loyalty with Defect Free Processes. Journal for Quality and Participation, 23 (4), 2000, pp. 32-36.

[11] Pande, P. S., Neuman, R. P., and Cavanagh, R. R. The Six-Sigma Way: How GE, Motorola, and Other Top Companies are honing Their Performance. New York: McGraw Hill, 2000, pp.7-13.