Implementation of Quality Control Tools and Techniques in Manufacturing Industry for Process Improvement

Heena Sharma[1], Dr. N.M Suri[2]

[1]Total Quality Engineering Management (TQEM), PEC University Of Technology, Chandigarh
[2] Production Engineering, PEC University Of Technology, Chandigarh

---

ABSTRACT - *Nowadays to survive in a competitive market, improving and productivity of product is a must for any company. We need to have better understanding of quality. By improving the quality, the method of optimization reduces process operational cost and product variation. This study is to apply Quality control tools in production process to reducing the rejection and rework by identifying where highest rejection occur at and to go give suggestions for improvement. This study is conducted from one of the Leading Manufacturing industries in Noida which manufactures Low voltage Panel board products. The approaches used in this study are such as Pareto chart, Fishbone diagram which have been applied to improve the quality of the products and minimize rejections. It has been founded that the company has many problems especially there is highly rejection and rework in the production processing lines. There is a various process parameters such as Punching, Bending, welding, grinding, Painting, Assembly and wiring process etc which have influence of the quality of final products have to be controlled in order to reduce the wastage and also there have been observed a need of improvement by using the quality control tools.*

Keywords:- Quality Control Tools, Pareto chart, Cause-effect Diagram.

INTRODUCTION

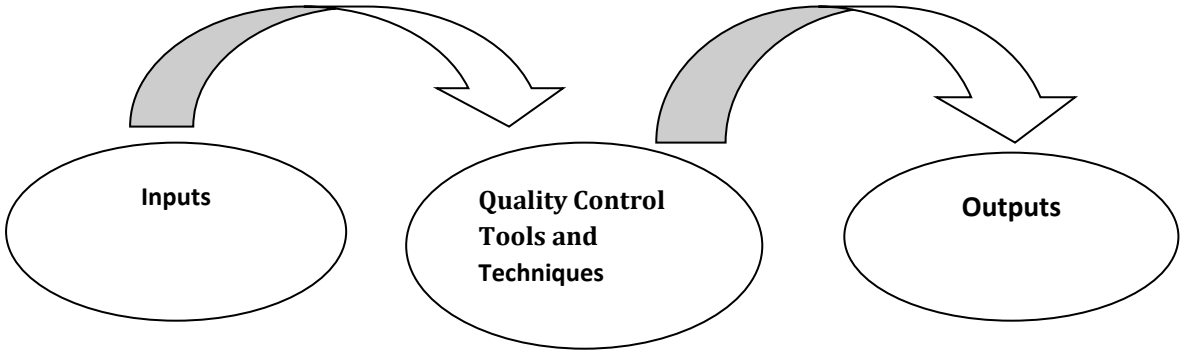
The growing competition in the current global market is an issue translating into a vast need for the continuing evolution of the industry. Therefore, world business is continually in search for the competitive edge due to the growing demands of customer needs and expectations. Quality has an important role in the business process across the entire organization, to be more efficient and effective in the global market, thus improving productivity and customer loyalty as well as increase market share. It is not only necessary to reduce the wastage, but also to satisfy customer's expectations, continuous cost reductions and continuous improvements to survive in highly competitive environment.

Quality improvement is a primary requirement in any production system that sends products or service as its outputs. Thus, it is a major goal in any manufacturing industry. Manufacturing industry spend a lot of efforts in maintaining and improving quality of their products using a variety of Control tools and techniques.

Quality concerns affect the entire organization in every competitive environment. It is not only necessary to reduce the wastage, but also to satisfy customer's expectations, continuous cost reductions and continuous improvements to survive in highly competitive environment.

Quality control tools can be applied in product development, production and marketing also .The quality control is aimed to satisfy the customers by delivery of defect free products. The research is aimed to investigate the successful Implementation of quality control tools and Techniques in manufacturing industry.

Quality Control Flow Chart



Work Result	Pareto Chart and Pareto Analysis	Quality Improvement
Checklists	Control Charts	Acceptance Decision
Operational Definitions	Flowcharting	Rework
Quality Management Plan	Cause & effect diagrams	
	Scatter diagrams	
	Histogram	
	Run chart	
	FMEA	

Fig1:- Quality Control Flow Chart

1.1 Benefits of Quality Control tools and Techniques:-

Quality Control tools implementation is important as it could improve process performance by reducing product variability and improves production efficiency by decreasing scarp and rework.

- Helps in Minimization of the rejection and rework.
- Helps in Enhance customer satisfaction by reduction in customer Complaints.
- Beneficial for reducing the production cost.
- Helps in finding the root causes of problem and improving production performance.

1.2 Quality control tools and techniques are:-

Understanding processes so that they can be improved by means of a systematic approach requires the knowledge of a simple kit of tools or techniques. The effective use of these tools and techniques requires their application by the people who actually work on the processes, and their commitment to this will only be possible if they are assured that management cares about improving quality. The tools and techniques most commonly used in process improvement are:

- • Process flowcharting
- Cause & effect diagrams
- Brainstorming
- Pareto analysis
- Control charts
- Check sheets
- Scatter diagrams
- Histograms
- FMEA

1.2.1 Check sheet

Check sheet is a structured table created by tallying each type of defect for a specified time. It shows the defects and how many time each type of defect occurred during that period. On the basis of collected information obtained the improvement actions can be taken for the improvement

1.2.2 Pareto Analysis

Pareto chart is frequency distribution of attribute data arranged by category. A Pareto chart can be used to quickly identify what business issues need attention. By using hard data instead of intuition, there can be no question about what problems are influencing the outcome most.

1.2.3 Process flowcharting

This is a powerful technique for recording, in the form of a picture, exactly what is done in a Process. The purpose of the flowchart is to learn why the current process operates and conduct and objective analysis, to identify problems and weaknesses, unnecessary steps or duplication and the objective of the improvement effort.

1.2.4 Cause and Effect Diagram

It is a visual tool that logically organizes possible causes for a specific problem or effect by graphically displaying them in increasing detail. Causes in cause and effect diagram are frequently arranged into four major's categories. These categories can be anything: Manpower, Methods, Materials and Machinery. It is sometimes called a fishbone diagram because of its fishbone shape. This shape allows the team to see how each cause relates to the effect.

1.2.5 Control charts

The control chart is a fundamental tool of statistical process control as it indicates that how a process changes over time.. Thus it helps to determine whether or not a process is operating consistently or if special cause has occurred to change process mean or variance.

1.2.6 Histogram

Histogram is a kind of bar chart which is used for measurement of data and showing a distribution of variables or cause of problems.

1.2.7 Scatter diagrams

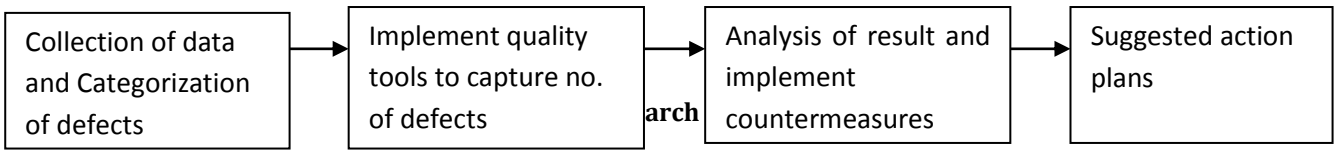
Scatter diagram is used to find the correlation between two variables. it used to show the relationship between two variables.

1.2.8 FMEA(Failure Mode Effect Analysis)

Failure Modes and Effects Analysis (FMEA) is a systematic, proactive method for evaluating a process to identify where and how it might fail and to assess the relative impact of different failures, in order to identify the parts of the process that are most in need of change.

2. RESEARCH METHODOLOGY

The Objective of this paper is to identify the defect of the company and create a better solution to improve the production line performance on implementation of Quality control tools in manufacturing process in order to eliminate production waste and minimize rejection and rework, improving production performance and to enhance customer satisfactions.



3. DATA COLLECTION

There are many quality related problems which were observed during the work in industry. Rejection data of materials due to defects occurred during the manufacturing process of the production has been taken from "Product reject 2016-2017" reports for about 6 months starting from Oct 2016 to March 2017 and is presented in Table1.1 It provide the total quantity produced by the industry.

S. No	Product Descriptions(LV Panel)	Total Quantity Produced (Oct2016-Mar2017)
1	MCC(Motor control centre) Panel	1534
2	PCC(Power Control Centre)Panel	1265
3	VFD/PLC Panels	963
4	Control Relay and Mimic Panel	980
5	Closed Transition S/D starter	860
6	Auto Transformer Starter	650
	Total	6,252

Table 1.1 List Electrical Control Panel (LV Electrical Panel) Produced by industry in (Oct 2016-Mar 2017)

3.1 Pareto chart

Pareto chart is a special type of chart where the plotted values are arranged from largest to smallest. A Pareto chart is used to highlight the most frequently occurring defects, the most common causes of defects, or the most frequent causes of customer complaints. To identify the main problems which cause frequent defects of LV Panels.

Table 1.2 Categorization of defects in LV Electrical Panels during in process and at final stage

S. No	Name of Defect	Rejections	Cumulative Rejection	Cumulative Rejection %
1	Poor Welding	490	490	26.7%

2	Paint thickness/shade	285	775	42.3%
3	Loose Connection	220	995	54.3%
4	Sheet Thickness	186	1181	64.4%
5	Stickers Missing	110	1291	70.4%
6	Poor Grinding	104	1395	76.1%
7	Mounting	98	1493	81.4%
8	Component Damage	89	1582	86.3%
9	Ear thing Connection	88	1670	91.1%
10	Wrong Bending	64	1734	94.5%
11	Thimble	60	1794	97.8%
12	Incorrect Hole Alignment	40	1834	100.0%

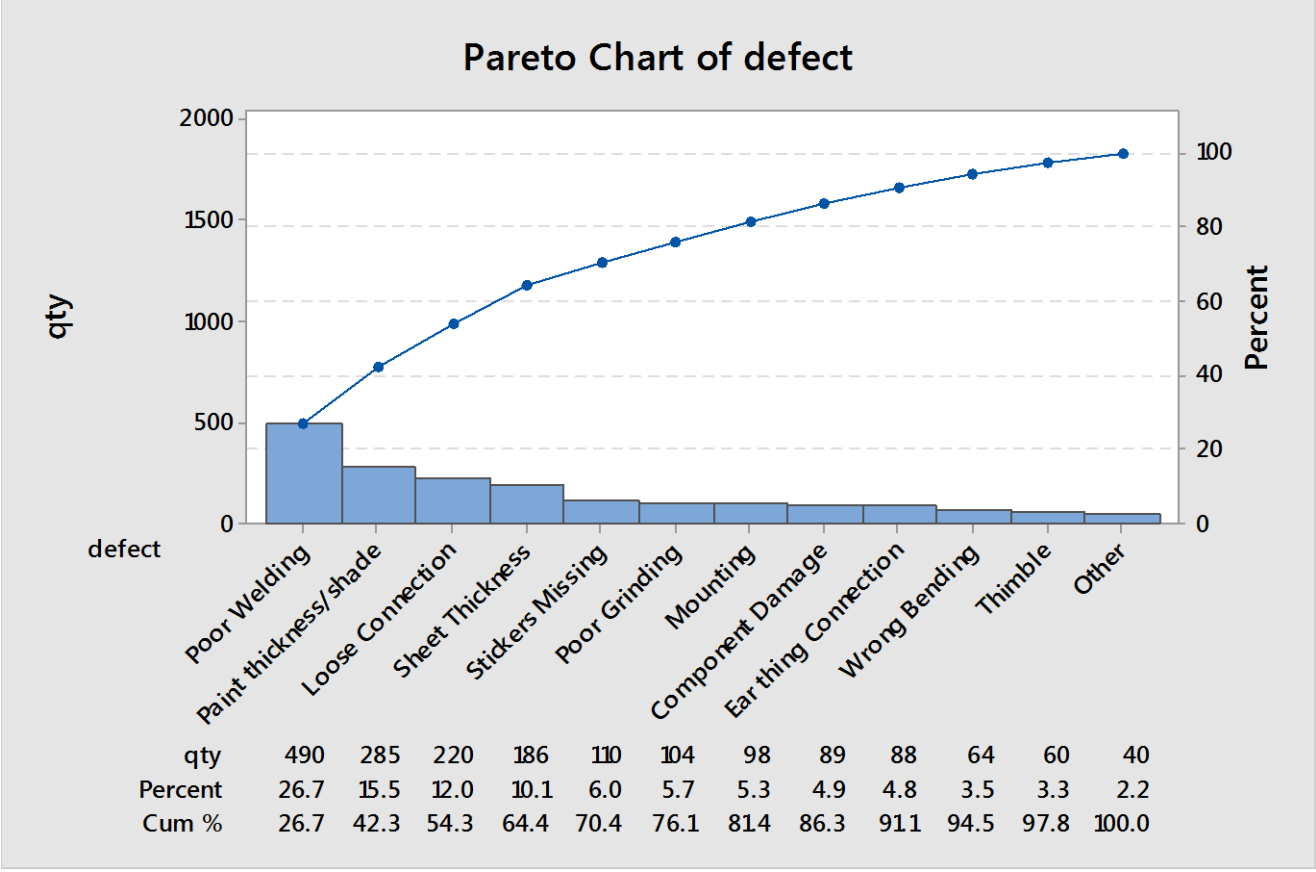


Fig 2:- Pareto Chart Analysis

Pareto chart was constructed based upon Number of defects collected from (Table 1.2) and to identify the most common defect as shown in Fig 2. The Pareto chart revealed that welding defect-26.7%, Paint thickness/shade-42.03%, and Loose connection-54.3%, sticker missing-70.4% . Only the major defects identified are chosen for the c study. Therefore, at this stage, it is obvious that most of all rejections (defects) will decrease, if the causes for these major defects are reduced.

3.2 Cause and Effect Diagram (Brainstorming)

Cause and Effect diagram are frequently arranged into four major's categories. These categories can be anything: Manpower, Methods, Materials and Machinery.

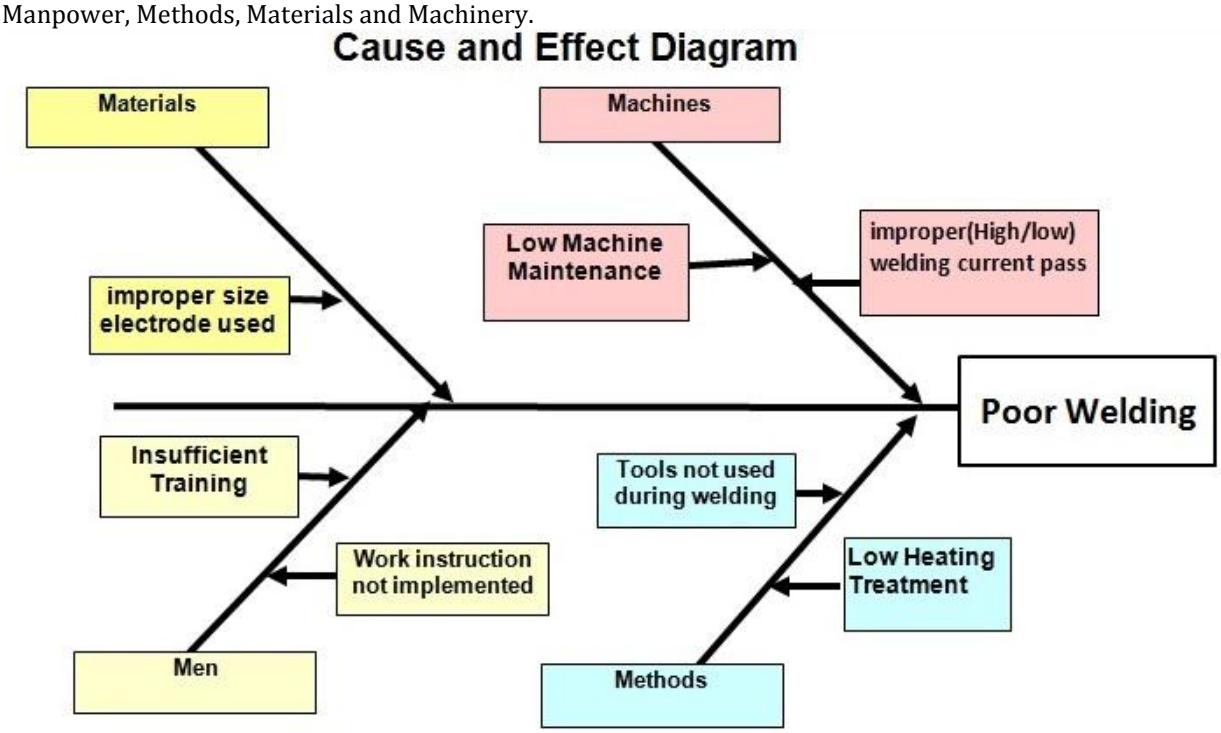


Fig3:- Cause and Effect diagram for Poor welding

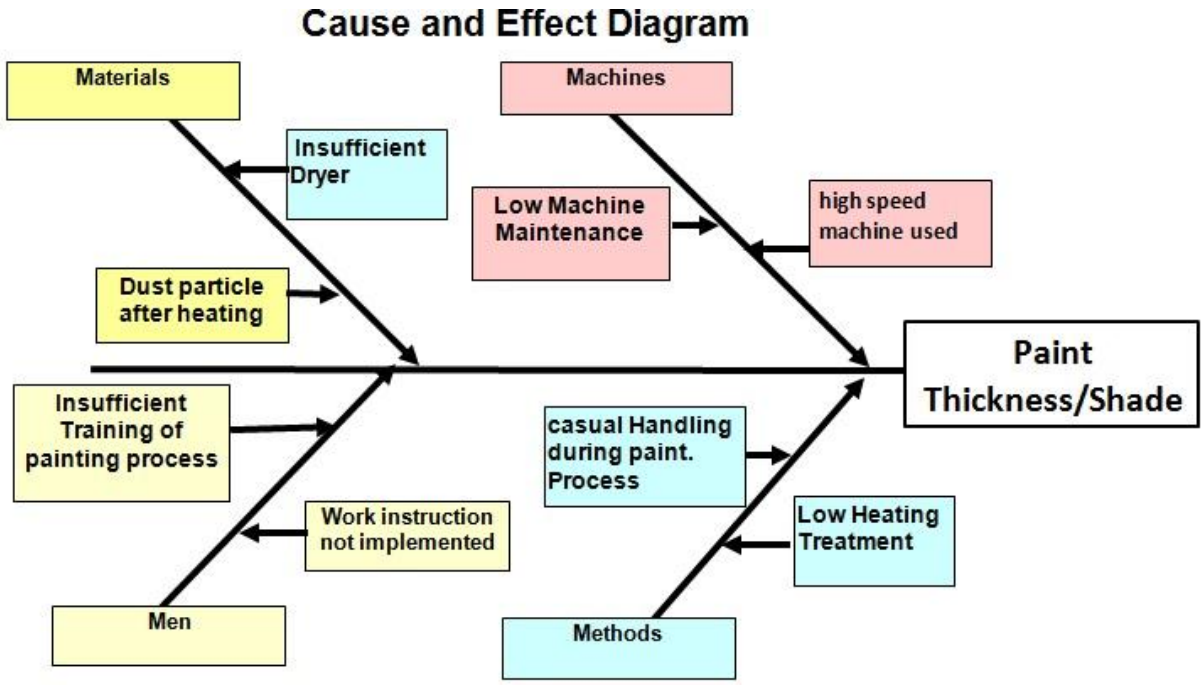


Fig 4: Cause and Effect diagram for Paint thickness/shade

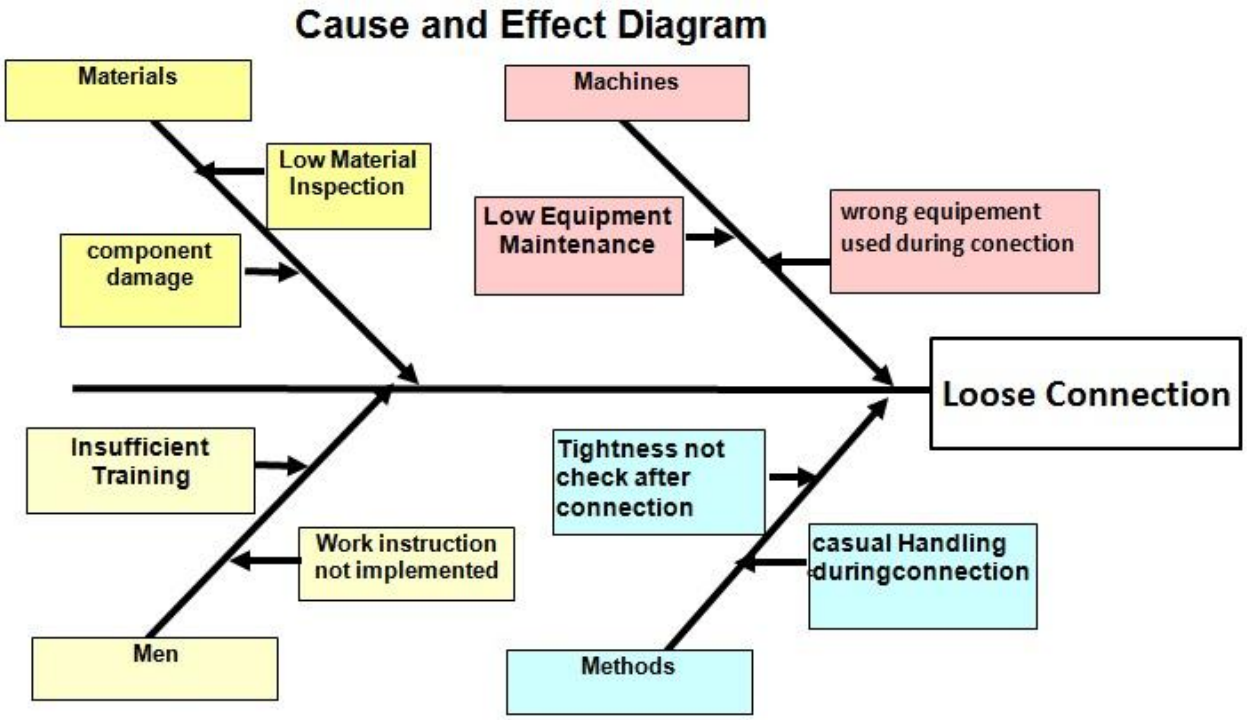


Fig 2: Cause and Effect diagram for Paint thickness/shade

5. SUGGEST ACTION PLAN

TYPE	**Suggest Action Plan for Poor Welding Defect**
Men(Operator)	➢ Provide the Sufficient training to worker ➢ Provide every machine work instruction to worker to avoid mistake
Machine(Equipment)	➢ Preventive Maintenance of every machine to ensure machine is in good working condition and avoid breakdowns ➢ Set appropriate welding current during work(Maintain welding current)
Material	➢ Must use appropriate quality raw material ➢ Improve material inspection
Method	➢ Appropriate tools used (Organize the tools before start the work) ➢ Maintain Heating Temp.(use only required temp.)
TYPE	**Suggest Action Plan for Paint Thickness/Shade**
Men(Operator)	➢ Provide the Sufficient training to worker ➢ Provide every machine work instruction to worker to avoid mistake
Machine(Equipment)	➢ Preventive Maintenance of every machine to ensure machine is in good working condition and avoid breakdowns. ➢ Must use machine with in speed limit and use machine operational manual(maintain machine speed during work)

Material	➢ Clean Work Area during work(remove unwanted material and dust particle) ➢ Use appropriate dryer during work ➢ Must use appropriate quality of raw material
Method	➢ Pay full attention during work ➢ Material handle carefully during loading and unloading ➢ Maintain Heating Temp. (use only required temp.)
TYPE	**Suggest Action Plan for Loose Connection**
Men(Operator)	➢ Provide the Sufficient training to worker ➢ Provide every machine work instruction to worker to avoid mistake ➢ Must have good attitude toward quality improvements.
Machine(Equipment)	➢ Preventive Maintenance of every Equipment to ensure machine is in good working condition and avoid breakdowns ➢ Use appropriate tool (organize the tools)
Material	➢ Improve Incoming Inspection
Method	➢ Check the connection strength after completion with machine. ➢ Properly handle the raw material

6. CONCLUSION

Quality leads to improvement in productivity and it also enhance the customer satisfaction. Study has been conducted to implement quality control tools and techniques in manufacturing industry. The main goal of this study is identify the defect and suggest a better solution to improve the production line performance on implementation of Quality control tools in manufacturing process in order to minimize the rejection and rework. Quality tools i.e. Pareto chart and Cause and effect diagram are used to identify and evaluate different defects and causes for these defects responsible for rejection/rework of materials at different stages (In process, Final Stage). In the Quality management system. Quality tools can be much wider applied with certain success. Quality tools are not so wider spread as expected although they are quite simple for application an easy for interpretations. Quality Control Tools could improve process performance by reducing product variability and improves production efficiency by decreasing scrap and rework.

7. REFERENCES

[1] Tarba Larisa Ing. (2016)," Quality Control Methods And Tools For Improvement Of Effectiveness Of Manufacturing Processes.

[2]. Deepak, Dhingra Dheeraj(2016)," Application Of Quality Control Tools In A Bicycle Industry: A Case Study," Ijret: International Journal Of Research In Engineering And Technology Eissn: 2319-1163 | Pissn: 2321-7308.

[3] Abohimed Bader(2001)," Identifying Some Management Approaches To Total Quality Management (Tqm) Withn Industerial Organziations,"

[4]. Singh Pal Ajit, Amedie Yimer Wassihun," Quality Improvement Using Spc Tools In Glass Bottles Manufacturing Industry," International Journal For Quality Research 7(1) 107–126 Issn 1800-6450.

[5] Ahmed Mohiuddin, Ahmad Nafis(2011)," An Application Of Pareto Analysis And Cause-And-Effect Diagram (Ced) For Minimizing Rejection Of Raw Materials In Lamp Production Process Management Science And Engineeringvol. 5, No. 3, 2011, Pp.87-95-Issn 1913-035x[Online].

[6] Singh Mohit, Khan I.A.,(*2012)* ," Tools And Techniques For Quality Management In Manufacturing Industries ," Proceedings Of The National Conference On Trends And Advances In Mechanical Engineering, Ymca University Of Science & Technology, Faridabad, Haryana, Oct 19-20.

[7] Biswas Prashant, Sharma Varun(2015) ," Rejection Reduction By Pareto Analysis," International Conference On Technologies For Sustainability-Engineering Infrpmation Technology,Management And The Environment,Isbn:978-81-931039-7-5.