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Implementation of Some Aspects of SQC Tools and Reduced Rejection in Manufacturing Industry: A Case Study

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Abstract: Producing high quality of products and services is one of the key concerns in order to keep up with the competition in the global markets. The main objective of manufacturing industries today is to increase productivity through system simplification and incremental improvements by using modern available quality techniques like Statistical Quality Control (SQC) Tools. In this paper we used some important quality tools (Statistical Quality Control Tools) and examine the change in result after considering and find out the factors which are responsible for maximum rejection. For completeness, some better alternatives to previously proposed procedures are also provided for the case where the process parameters are assumed known in advance of productionIn the light of the above mentioned facts problem solving techniques gain an increased importance in context of Indian industries Method has become an important approach in order to produce quality products and reduced rejection ration This method is very important tool by rejection in operation of a system may be eliminated. Various techniques may be applied to reduce or eliminate rejection and error in manufacturing process

Keywords: Quality Management, Quality Control, Control charts.

1. QUALITY CONTROL TECHNIQUES: AN INTRODUCTION

1.1 Introduction

In preparing to introduce a quality improvement initiative, managers must create a supportive environment for this initiative, form and train a team to implement the initiative, and work with the team to focus on the needs and priorities defined by users of their health services One way to start to improve quality is to solve existing problems. To begin the process for the first time, think about a small but important problem that is likely to be resolved with some thought and work. Start by envisioning that problem as having the six distinct steps illustrated in the graph above. A small project in the beginning serves as a tool for learning about quality improvement and as a catalyst for change. Choose a problem that is both important and manageable. If the problem is important, its resolution will also be visible, and the perceived improvements will invite increased interest in the quality improvement efforts. If the scope of the problem is manageable, resolution is more likely and learning is more focused. It is essential that the first problem solving cycle be a success. [14]

1.2 Quality

A sample is a collection of numbers (measurements or counts) on the quality characteristic (QC) of process variable (PV) of units drawn from a process. A sample unit is a part of the process on which the QC or PV is measured. The units may be patients, incidents, time (day of week), a form, an incoming shipment of material—all of which are integrally related to process.

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1.1 Table Definition of Quality

1.Customer – Based	Fitness for use , meeting customer expectations.
2. Manufacturing –Based	Conforming to design, specifications, or requirements. Having no defects.
3. Product- Based	The product has something that other similar products do not adds value
4. Value- Based	The product is the best combination of price and features
5. Transcendent	It is not clear what it is, but it is something good…

1.3 Total Quality Control

Total Quality Control defined as an effective system for intergrating the quality development, quality maintenance and quality improvement efforts of the various groups in an organisation so as to enable production and service at the most economical level which allow for full customer satisfaction. It may be classified as a ‘‘Management Tool’’ for many industries outstanding improvement in product quality design and reduction in operating costs and losses. Product quality is defined as ‘‘the composite product of engineering and manufacture that determine the degree to which the product in use will meet the expectations of the customer’’. ‘‘Control’’ represents a tool with four steps:

i. Setting up of quality standards.
ii. Appraising conformance to these standards
iii. Acting when these standards are exceeded.
iv. Planning for improvements in these standards.

1.4 Statistical Quality Control

A Quality control system performs inspection, testing and analysis to conclude whether the quality of each product is as per laid quality standard or not. It’s called ‘‘Statistical Quality Control’’ when statistical techniques are employed to control quality orto solve quality control problem. SQC makes inspection more reliable and at the same time less costly. It controls the quality levels of the outgoing products. SQC should be viewed as a kit of tools which may influence related to the function of specification, production or inspection. Controlling the quality of products so as to maintain it at a given level is a major problem in production. Production has been trying to use some men, machine and raw materials in the hope of turning out of uniform quality. But neither men nor machine are infallible and cause of irregularity often creeps in inadvertently. As a result, rejection in finished materials are rarely eliminated and inspection and screening because necessary for varied extents depending on the nature of the products.

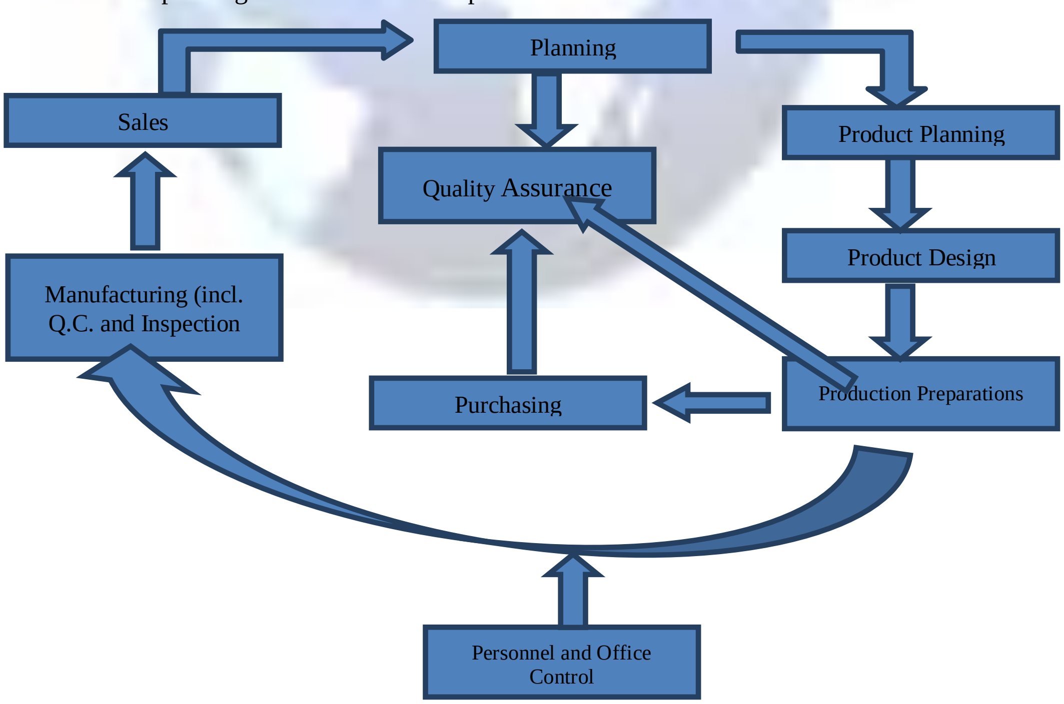

Fig. No. 1.1: Concept of Gross Functions for Quality Management

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1.4.1 Statistical Quality Control (SQC)

SQC is the term used to describe the set of statistical tools used by quality professionals. Statistical quality control can be divided into three broad categories:

i. Descriptive statistics are used to describe quality characteristics and relationships. Included are statistics such as the mean, standard deviation, the range, and a measure of the distribution of data.
ii. Statistical process control (SPC) involves inspecting a random sample of the output from a process and deciding whether the process is producing products with characteristics that fall within a predetermined range. SPC answers the question of whether the process is functioning properly or not.
iii. Acceptance sampling is the process of randomly inspecting a sample of goods and deciding whether to accept the entire lot based on the results. Acceptance sampling determines whether a batch of goods should be accepted or rejected. The tools in each of these categories provide different types of information for use analysing quality.

1.4.2 Principles of Statistical Quality Control

The principles that govern the control of quality in manufacturing are:

i. Control of quality increases output of saleable goods, decreases costs of production and distribution, and makes economic mass production possible.
ii. The quality of manufactured goods is variable with an upward trend under conditions of competitive manufacturing.
iii. The conformance of finished product to its design specifications and standards should be accomplished by avoiding the making of non-conforming materials rather than by storing the good from the bad after manufacturing is completed.

1.4.2.1 Vision SQC

To be the leading changing agent in industry enhancing its competitive edge to achieve the sustainable growth through learning organization.

1.4.2.2 Mission SQC

To support the society and industry through strategic partnership in total business management solution.

1.4.3 Objectives

To solve the problems using various quality tools.

1. **Identifying the problem—**which problem should I address? If there are several, how do I choose the most important one?
2. **Describing the problem—**how do I accurately and completely describe the problem?
3. **Analyzing the problem—**what are the different causes of the problem, and which causes are most important to solve right away?
4. **Planning the solutions—**what are the different alternative solutions for solving the problem?
5. **Implementing the solutions—**how do I make sure the solutions are implemented correctly and effectively?[6]
6. **Monitoring/evaluating the solution--**How did the solutions work? What needs to be changed?

1.4.4Benefits/Advantages of Statistical Quality Control:

Benefits & advantages of statistical quality control are as follows:
1. It provides a means of detecting error at inspection.
2. It leads to more uniform quality of production.
3. It improves the relationship with the customer.
4. It reduces inspection costs. It reduces the number of rejects and saves the cost of material.
5. It provides a basis for attainable specifications.

1.5 Seven Basic Tools of Quality

The Seven Basic Tools of Quality is a designation given to a fixed set of graphical techniques identified as being most helpful in troubleshooting issues related to quality.They are called basic because they are suitable for people with little formal training in statistics and because they can be used to solve the vast majority of quality-related issues. Seven Management and Planning tools are given below.

The seven tools are:

i. Check sheet
ii. Stratification (alternately, flow chart or run chart)
iii. Histogram
iv. Cause-and-effect diagram (also known as the "fishbone" or Ishikawa diagram)
v. Pareto chart
vi. Control chart
vii. Scatter diagram

1.5.1 Check Sheet

1.5.1.1 Definition

A simple data collection form consisting of multiple categories with definitions. Data are entered on the form with a simple tally mark each time one of the categories occurs.

1.5.1.2 Purpose

To facilitate the collection and analysis of data

A check sheet is a simple means of data collection. The most straightforward check sheet is simply is simply to make a list of items that you expect will appear in a process and to mark a check beside each item when it does appear. This type of data collection can be used for almost anything, from checking off the occurrence of particular types of defects to the counting of expected items (e.g. the number of times the telephone rings before being answered).

i. Clearly define the objective of the data collection.
ii. Determine other information about the source of the data that should be recorded, such as shift, date, or machine.
iii. Determine and define all categories of data to be collected and who will collect the data.
iv. Determine how instructions will be given to those involved in data collection.
v. Design a check sheet by listing categories to be counted.
vi. Pilot the check sheet to determine ease of use and reliability of results.
vii. Modify the check sheet based on results of the pilot.

1.5.2 Stratification

1.5.2.1 Definition

Knowledge of the process allows you to group things so that you get the most information from your data collection for the effort expended. This called stratification. Creative thinking is usually required to select possible groupings, or strata, within which sample units will be taken. Examples of possible strata are

Acuity Day of Week
Zip code
Sex
Age
Weight

1.5.2.2 Purpose

Allows you have to better understand the variation in your QC or PV by aligning data with known groups in the process.

1.5.2.3 Guidelines

i. The sample units must be in sequence and serially numbered.
ii. The grouping variable must be selected based on process knowledge.

1.5.2.4 Types of Stratification

1.5.2.4.1 Pre-stratification:

This occurs when the team breaks the data collection into smaller groups prior to collecting data, because they know the grouping. In pre-stratified samples, you plan to collect enough data in the strata to establish a run chart for those strata.

1.5.2.4.2 Post-Stratification:
This occurs when the team collects additional information during data collection such as triage level. They then separate the data into groups based on this additional information after data collection is complete. In post-stratified samples, there is usually not enough data in the strata to establish a run chart and, hence, further data collection may be necessary. In both types of stratification, the data are analyzed within the strata or groupings. Prior to data collection, stratify to the maximum extent that you can based on your knowledge of the process (pre-stratification).If you are unsure of the impact of some potential stratifying factor, plan to collect the data necessary to post-stratify on it.

1.5.3 Histogram
Overview: This histogram tutorial will provide information on how to construct and interpret histograms for use in quality process control (Q.C.). The main areas explained are:
a) Histogram Background
b) Creating a Histogram
c) Interpreting Histogram
d) Recommended Additional Q.C. Topics and Software

Purpose: The purpose of the tutorial is to let you become familiar with graphical histogram, which is used widely in quality control (Q.C.). Histograms are effective Q.C. tools, which are used in the analysis of data. They are used as a check a specific process parameters to determine where the greatest amount of variation occurs in the process, or to determine if process specifications are exceeded. This statistical method does not prove that a process is in a state of control. Nonetheless, histograms alone have been used to solve many problems in quality control.

1.5.4 Cause & Effect Diagram

1.5.4.1 Introduction
When utilizing a team approach to problem solving there are often many opinions as to the problems root cause. One way to capture these different ideas and stimulate the teams brainstorming on root causes is the cause and effect diagram, commonly called a fishbone. The fishbone will help to visually display the many potential cause for a specific problem or effect. It is particularly useful in a group setting and for situations in which little quantitative data is available for analysis.

The fishbone has an ancillary benefit as well. Because people by nature often like to get right to determining what to do about a problem, this can help bring out a more thorough exploration of the issues behind the problem- which will lead to a more robust solution.

1.5.5 Pareto Chart

1.5.5.1 Introduction
It is a bar graph used to arrange information in such a way that priorities for process improvement can be established. Pareto analysis is way of organizing data to show what major factors (s) are significantly contributing to the effect being analyzed (i.e., how much each cause contributed to the problem at hand). Such analysis can help you:

i. choose a starting point for problem solving
ii. identify the Root Cause of a problem
iii. monitor success in a process improvement program

A Pareto Chart is a type of histogram in which the height of each bar represents the relative contribution of that element to the overall problem. Consistent with the "80-20" rule ("80% of the results are produced by 20% of the causes"), Pareto Charts usually reveal that a majority of the problematic results of process can be traced to only a few specific causes. Having identified the Root Causes with a Pareto Chart, you can then make changes to the process, confident that you are working with the "vital few" sources of problems rather than the "trivial many".

1.5.6 Control charts

Control charts, also known as Shewhart charts (after Walter A. Shewhart) or process-behaviour charts, in statistical process control are tools used to determine if a manufacturing or business process is in a state of statistical control. If analysis of the control chart indicates that the process is currently under control (i.e., is stable, with variation only coming from sources common to the process), then no corrections or changes to process control parameters are needed or desired. In addition, data from the process can be used to predict the future performance of the process. If the chart indicates that the monitored process is not in control, analysis of the chart can help determine the sources of variation, as this will result in degraded process performance. A process that is stable but operating outside of desired (specification) limits (e.g., scrap rates may be in statistical control but above desired limits) needs to be improved through a deliberate effort to understand the causes of current performance and fundamentally improve the process.

1.5.7 Scatter Diagram

A scatter plot is used when a variable exists that is under the control of the experimenter. If a parameter exists that is systematically incremented and/or decremented by the other, it is called the control parameter or independent variable and is customarily plotted along the horizontal axis. The measured or dependent variable is customarily plotted along the vertical axis. If no dependent variable exists, either type of variable can be plotted on either axis or a scatter plot will illustrate only the degree of correlation (not causation) between two variables. A scatter plot can suggest various kinds of correlations between variables with a certain confidence interval. For example, weight and height, weight would be on x axis and height would be on the y axis. Correlations may be positive (rising), negative (falling), or null (uncorrelated). If the pattern of dots slopes from lower left to upper right, it suggests a positive correlation between the variables being studied. If the pattern of dots slopes from upper left to lower right, it suggests a negative correlation. A line of best fit (alternatively called 'trend line') can be drawn in order to study the correlation between the variables. An equation for the correlation between the variables can be determined by established best-fit procedures.

1.6 Pie Chart

A pie chart (or a circle chart) is a circular statistical graphic, which is divided into slices to illustrate numerical proportion. In a pie chart, the arc length of each slice (and consequently its central angle and area), is proportional to the quantity it represents. While it is named for its resemblance to a pie which has been sliced, there are variations on the way it can be presented. Pie charts are very widely used in the business world and the mass media. However, they have been criticized, and many experts recommend avoiding them, pointing out that research has shown it is difficult to compare different sections of a given pie chart, or to compare data across different pie charts. Pie charts can be replaced in most cases by other plots such as the bar chart.

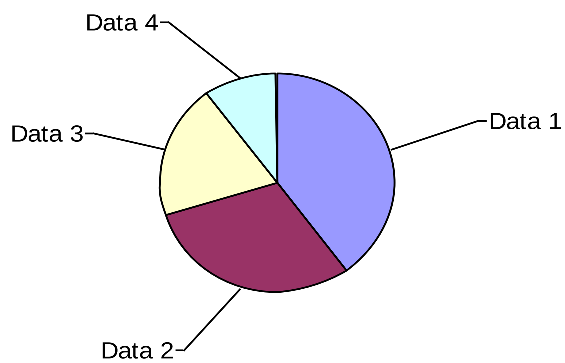

Fig. No. 1.2: Bar Chart

1.7 Brainstorming

Brainstorming helps a group create as many ideas as possible in as short a time as possible. Typically, brainstorming should only take about 5 to 10 minutes to generate 25 or 30 ideas. This rapid pace helps creative thinking. Ideas are written down on a flip chart. Discussion and criticism are not allowed. Brainstorming is a group or individual creativity technique by which efforts are made to find a conclusion for a specific problem by gathering a list of ideas spontaneously contributed by its member(s). Osborn claimed that brainstorming was more effective than individuals working alone in generating ideas, although more recent research has questioned this conclusion. Today, the term is used as a catch all for all group ideation sessions. Brainstorming activity conducting:

i. **Focus on quantity**: This rule is a means of enhancing divergent production, aiming to facilitate problem solving through the maxim quantity breeds quality.

ii. **Withhold criticism**: In brainstorming, criticism of ideas generated should be put 'on hold'. Instead, participants should focus on extending or adding to ideas, reserving criticism for a later 'critical stage' of the process. By suspending judgment, participants will feel free to generate unusual ideas.

iii. **Welcome unusual ideas**: To get a good and long list of ideas, unusual ideas are welcomed. They can be generated by looking from new perspectives and suspending assumptions.

2. LITERATURE REVIEW

The Harvard Business Review published a thought-provoking article ‘‘Successful Change Programs Begin with Results” (Schaffer and Thomson 1992). Schaffer and Thomson report that quality programs are easily derailed when the focus is on activity-centred quality programs, and they describe the basic flaws and solutions for such failed efforts. Too often the focus of change programs is centred on activities rather than results, and the end becomes confused with the means—processes with outcomes. Deming (1986) alludes to this concept when discussing his “Do Something!” theory in his book Out of the Crisis.In the late 1988s, one of the largest U.S. financial institutions was committed to a TQM program to improve operational performance. The company trained hundreds of employees. At the end of a 2-year costly effort, the company reported the results of their TQM program, as summarized in the following: 48 quality improvement teams are up and running; two quality improvement stories are completed; morale of employees regarding TQM is very positive. Nowhere did the report show any bottom-line performance improvements because there were none.

A large mineral-extracting firm stated their TQM program accomplishments as 50% of the training and employee participation goals were met but only about 5% bottom-line improvement. Another company's success consisted of getting 100% of each division's employees to attend a quality training program, but n0n mention of quality improvements within the company. In a 1991 survey of electronic companies, it was found that 73% of the companies reported had a TQM program, but of these, 63% had failed to reduce quality defects by even as much as 10%. [22]The field of quality has its roots in agriculture. Early this century in Brita in, R.A Fisher conducted statistical research to assist farmers in understanding how to optimally plant and rotate crops. This work subsequently inspired Walter Shewart at Bell Laboratories, whose work subsequently Motivated W. Edward Deming to devote his life to the teaching and Improvement of quality methods. Arguably, Deming have become the best-known ‘guru’ of quality. Both Deming and Juran could find no interest in quality methodologies in the U.S. before the World War II. However, both statisticians were invited to Japan as consultants to ‘spread the word ‘about quality .In Japan, they found a receptive audience for their ideas.

The term quality means different things to different people. For example, A quality automobile may be one which has no defects and works exactly as we except. Such a definition would fit with an oft-repeated definition by J.M Juran (1988[3]): “Quality is fitness for use.” However, there are other definitions widely discussed. Quality as “conformance to specifications” is a position that people in the manufacturing industry often promote. Why? Presumably because manufacturing can do nothing to change the design, hence this definition others promote wider views (Gitlow et al., 1989[6] or Ozeki and Asaka, 1993[18]), At that time, companies that had set about training their workforces in statistical quality control found that the complexity of the subject intimidated the vast majority of their workers and scaled back training to focus primarily on simpler methods which suffice for most quality-related issues.[8]Results-driven efforts bypass lengthy preparations and aim at quick, measurable gains within a few months rather than years. Investment is less, and improvement goals are short term.

Top management takes action steps because they lead directly toward improved results, not promises of a someday hopeful gain (Schaffer and Thomson 1992[10]). Implement the solution and follow-up (monitor and report results).The Memory Jogger (1988[3]) also describes where and how to use many of the quality improvement tools.Pareto analysis is a simple bar graph that shows the relative importance of all problems or causes to one another. This helps to make a decision on where to start solving problems or to identify basic causes of a problem. Pareto analysis summarizes information from a check sheet (discussed previously) or other forms of data from records. Department of the Navy (San Diego, September 1993[16]).Cause and effect diagrams (also called fish bone diagrams) are used to identify, explore, and display possible causes of a specific problem. Possible causes of a problem are grouped into major categories, such as people, machines, methods, materials, and environment. Each category is further broken down into possible causes (Brassard, M. (1988[5])). These causes can be further broken down into detailed causes. A detailed cause and effect diagram looks like fish bones. Causes of a problem are developed from brainstorming or information collected on check sheets. From the cause and effect diagram, the most likely cause of the problem is selected for further analysis (San Diego, 1992[11]).

3. INDUSTRIAL CONCEPT FOR QUALITY MANAGEMENT - A CASE STUDY

3.1 Introduction

This study is based on how to control in process rejection to improve quality of product in shop floor at Munjal Showa by improving quality of that particular product we can increase PPM & as well as we can reduce rejection cost of that particular part . The aim of present study was findingouttheimprovementsthathaveimplementedandalsotonotethe further changesthat willdo tokeepthe loopof continuousimprovementgoing.

3.2 Improvements

i. Proper Documentation: This project was carried out by compiling existing data record of the company. The company till date has a huge record of various rejections and acceptance records, but this project has given an insight as to how to store there cords and document the details so that the information can be readily used for the analysis.

ii. Use of Indicators: Generally a company works on many items and with many divisions. It becomes very difficult to analyse the qualitatively and quantitatively because of unavailability of proper performance indicators for analysis. This main indicator is described as Percentage rejection, which has been used repetitively in our project work. Another performance indicator that has been set was Category wise percentage Rejection.

iii. Availability of analysis tools. The QC tools used in this project work are as an analysis tool for evaluation of supplier quality. It also has a use of check sheets, histograms & Pareto sheets, which act as control tools when it comes to controlling quality of supplier end parts.

3.3 Munjal Showa History

3.3.1 Munjal Showa Limited

Established in 1985, in technical and financial collaboration with Showa Corporation of Japan, the pioneering global leaders in the manufacture of shock absorbers, Munjal Showa Limited is a member of Hero Group, a US $ 1.3 billion manufacturing conglomerate, with a 45-year history. The Hero Group, a major player in the manufacturing sector in India, comprises of 15 active companies with complete backward integration for automotive manufacturing. Prime companies in the Group are: Hero Honda Motors Limited, a joint venture with Honda Motors of Japan, Hero Cycles, the largest bicycle manufacturer in the world, Majestic Auto Limited and Hero Punch, manufacturing mopeds and scooters. Munjal Showa Limited in its joint venture with Showa Corporation, designs and manufacturers shock absorbers and struts for leading two-wheelers and four-wheelers. The Munjal Showa manufacturing plant is spread over an area of 24075 sq.mtr. In the industrial area of Gurgaon, Haryana, in the outskirts of the National capital territory of Delhi, (India). Today Munjal Showa Limited is one of the largest suppliers of shock absorbers to major auto giants in India, Japan, Germany, the United States and the United Kingdom, amongst other developed markets. The company's products conform to the highest standards of quality, safety, comfort and dependability and are QS 9000, ISO 14001 and ISO 9001 compliant. The use of advanced technology and a team of experienced personnel have led to outstanding growth in the Company.

3.4 Case study

A study was done on fork pipe line rejection, internal rejection & internal rework for the period of Sep'14 to Dec'14 on fork pipe line machining & grinding. According to collected data, it is analysed that most of rejection in machining & grinding process .As per observation average rejection & rework in fork line from Sep 2014 to Nov 2014 in machining & grinding is 20607 no's. as per data collected machining defect 1782 no's or 8.64% & grinding defect is 18825 no's or 91.36% as per observation grinding defects are more as compare to grinding defects.

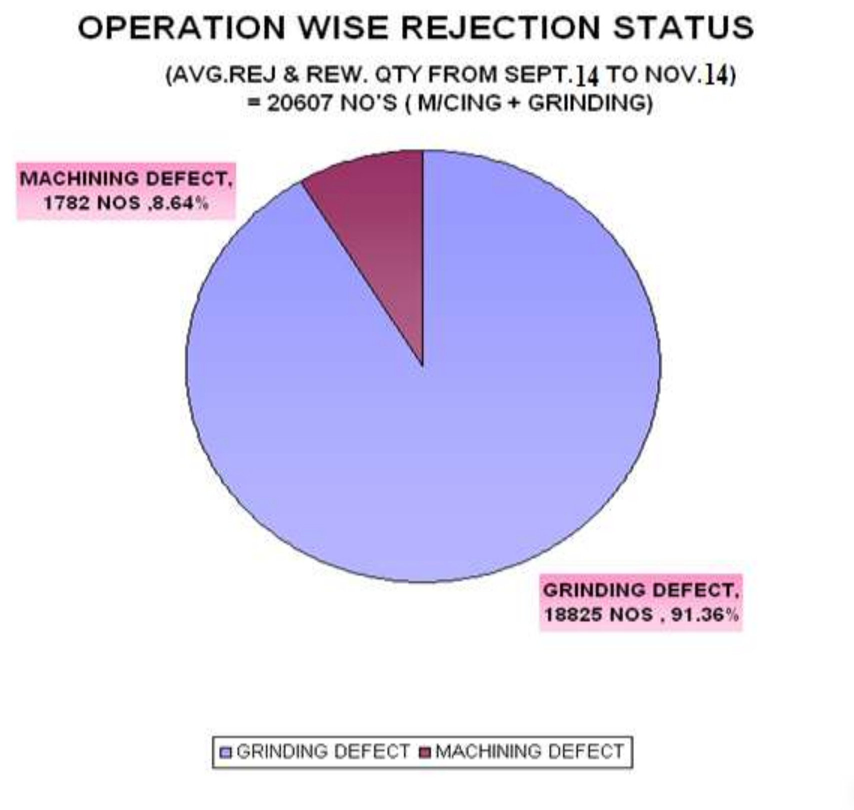

Fig. No 3.1 : explaining rejection by pie chart

As per observed operation wise rejection pareto chart apply for grinding and machining process

3.4.1 Pareto Chart for Grinding Defects

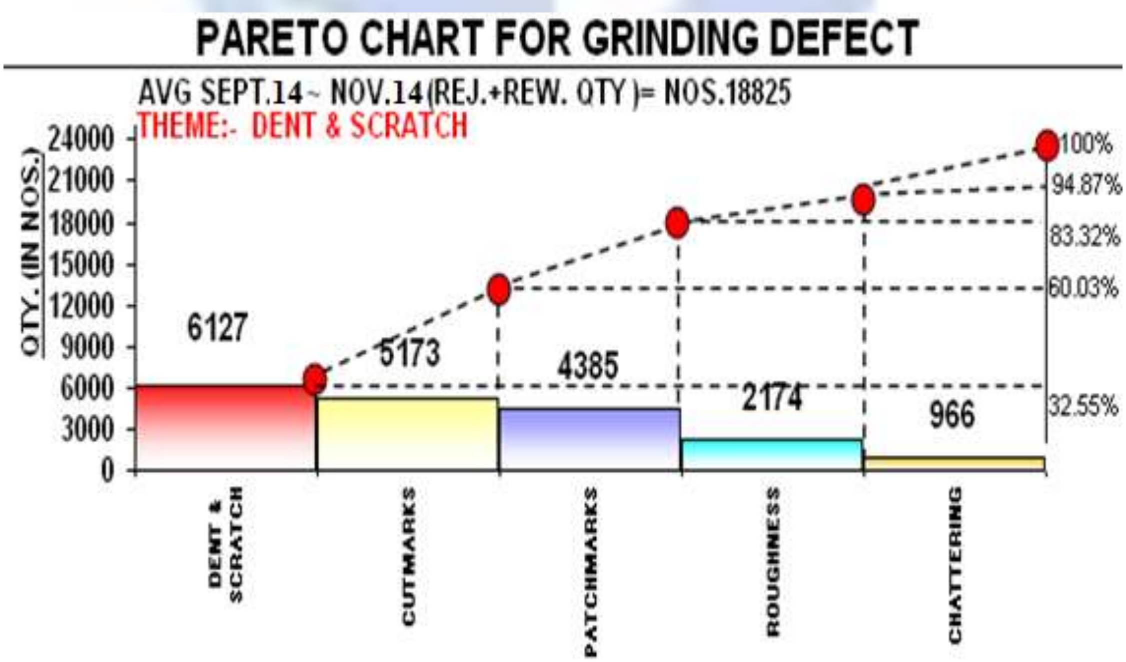

Fig. No. 3.2:- Explaining Grinding defect by pareto chart

3.4.2 Pareto Chart for Machining Defects

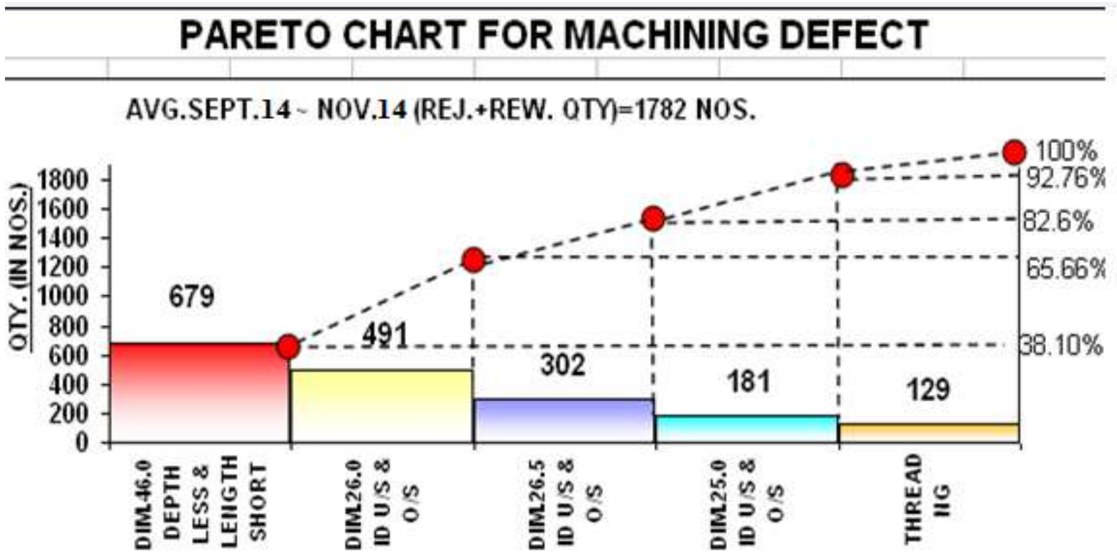

Fig. No. 3.2: Explaining Grinding defect by pareto chart

- After studying pareto chart for grinding & machining process, we plan a schedule for reducing 30% rejection, PPM & cost.

Table No 3.2:- Target for reducing rejection

IMPLEMENTATION SCHEDULE					
S.No	Item	Schedule for month Dec, 14			
		W-1	W-2	W-3	W-4
1	DATA COLLECTION				
2	CAUSE FINDING				
3	COUNTERMEASURE				
4	FEED BACK				

TARGET (30% REDUCTION)		
ITEM	BEFORE CM	AFTER CM
QTY. (NOS)	6127	4289
PPM	11383	7968
COST	612700	428890

During study we find that most of rejection is at grinding process so we select grinding process for reducing rejection .As per planed schedule we collect data from grinding process in complete operation total six set of grinder used. As per collected data there are four possible reasons for rejection

i. Centre plate wears out
ii. Pitch conveyor belt misalignment
iii. Metal to metal contact during fork pipe keeping after machining
iv. Guide plate misalignment

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MSLM	POSSIBLE REASONS OF DENT & SCRATCH						
S.NO.	CAUSE	SET 1	SET 2	SET 3	SET 4	SET 5	SET 6
1	CENTRE PLATE WEAR OUT	√	√	√	ROUGH GRINDER	√	SEMI FINAL GRINDER
2	PITCH CONVEYOR BELT MISALIGNMENT	√	√	√	FINAL GRINDER	√	FINAL GRINDER
3	METAL TO METAL CONTACT DURING FORK PIPE KEEPING AFTER M/CING.	●	√	√	√	●	●
4	GUIDE PLATE MISALIGNMENT	SEMI FINAL GRINDER	√	√	FINAL GRINDER	√	SEMI FINAL GRINDER

Table No 3.3:- Possibility of rejection on each grinder set

Most of the rejections for these particular causes are at two operations set 4 and at set 6 in six sets of grinder. Data collected for set wise rejection will be batter understood in the form of histogram.

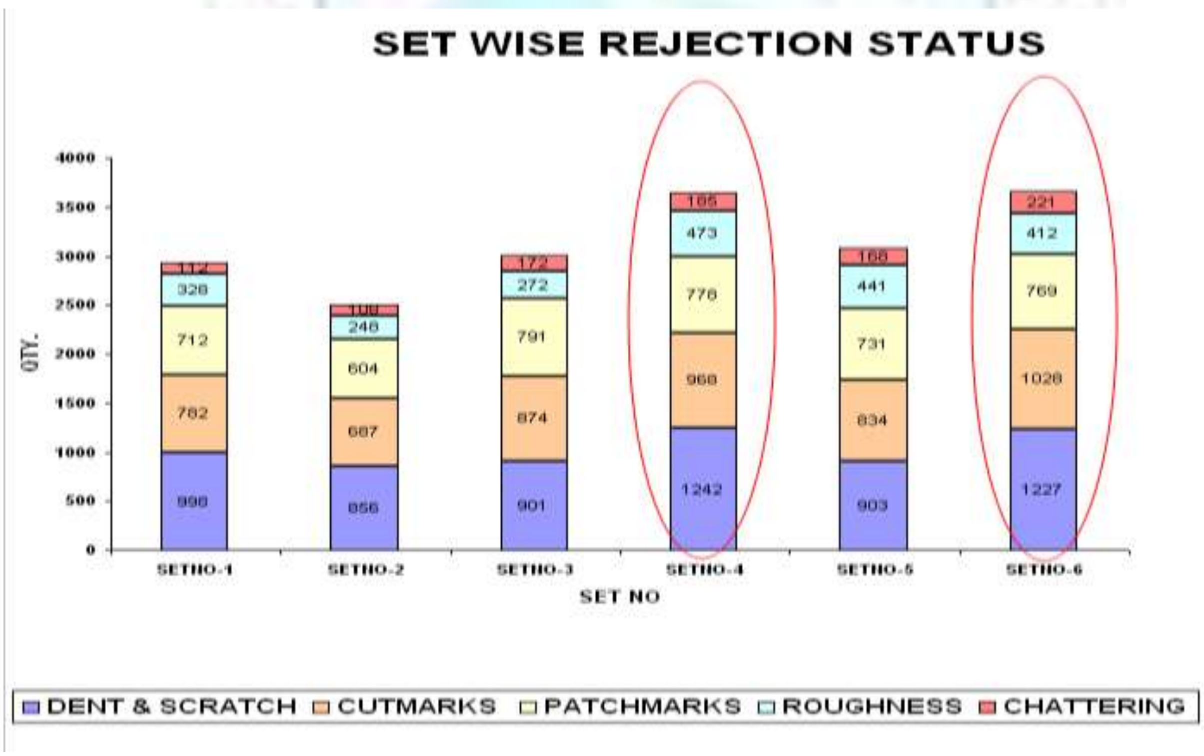

Fig. No. 3.4:- Rejection shown by histogram

With the help of histogram it is easy to find how much rejection & what type of rejection on particular stations. Now apply cause & effect to find reason for four particular problems

Table No 3.4 : Cause & effect analysis

Cause Investigation		
S.no	Problem	Reason
1	Centre plate wear out	Due to wear out of centre plate on set no 4 rough grinder & set no 6 semi final grinder dent & scratch observed.
2	Pitch conveyor belt misalignment	Due to misalignment of pitch conveyor belt on final grinder on set no 4& 6 pipe strikes with each other so dent & scratch observed.
3	Metal to Metal contact during fork pipe keeping	Due to metal to metal contact during pipe keeping after maching on set no1,5 & 6. dent & scratches observed on fork pipe OD.
4	guide plate misalignment	Due to misalignment of guide plate on final grinder on set No.4 & semi Final grinder on set no 1 & 6 pipe strikes with it, so dent & scratch

With help of cause & effect it's clearly known about the secondary reasons for rejection during grinding process.

3.5 Countermeasure:

Reason: - Due to wear out of centre plate on set no 4 rough grinder & set no 6 semi-final grinder dent & scratch observed.
Countermeasure: - Centre plate changed on set no 4 & 6.
Reason: - Due to misalignment of pitch conveyor belt on final grinder on set no 4& 6 pipe strikes with each other so dent & scratch observed.
Countermeasure:- Pitch conveyor belt misalignment rectified on set no 4 & 6.
Reason: - Due to metal to metal contact during pipe keeping after machining on set no1,5 & 6. Dent & scratches observed on fork pipe OD.
Countermeasure:-PVC sheet provided on pipe keeping trolleys on set no 1,5 & 6.
Reason :- Due to misalignment of guide plate on final grinder on set No.4 & semi Final grinder on set no 1 & 6 pipe strikes with it, so dent & scratch observed.
Countermeasure: - Misalignment of guide plate rectified on set no 1,4&6.

Table No 3.5: Schedule or countermeasure

Schedule for countermeasure					
S.no	Countermeasure	W1	W2	W3	W4
1	Centre plate changed on set no 4 & 6.	RECTIFIED ON 07.12.14			
2	Pitch conveyor belt misalignment rectified on set no 4 & 6.		RECTIFIED ON 14.12.2014		
3	PVC sheet provided on pipe keeping trolleys on set no 1,5 & 6.			RECTIFIED ON 19.12.2014	
4	Misalignment of guide plate rectified on set no 1,4&6.				RECTIFIED ON 26.12.2014

After applying above countermeasure again data collected for particular operations, with the help of these data it is clearly understood that we are on the right path for reducing rejection .It is clear by below feedback graph.

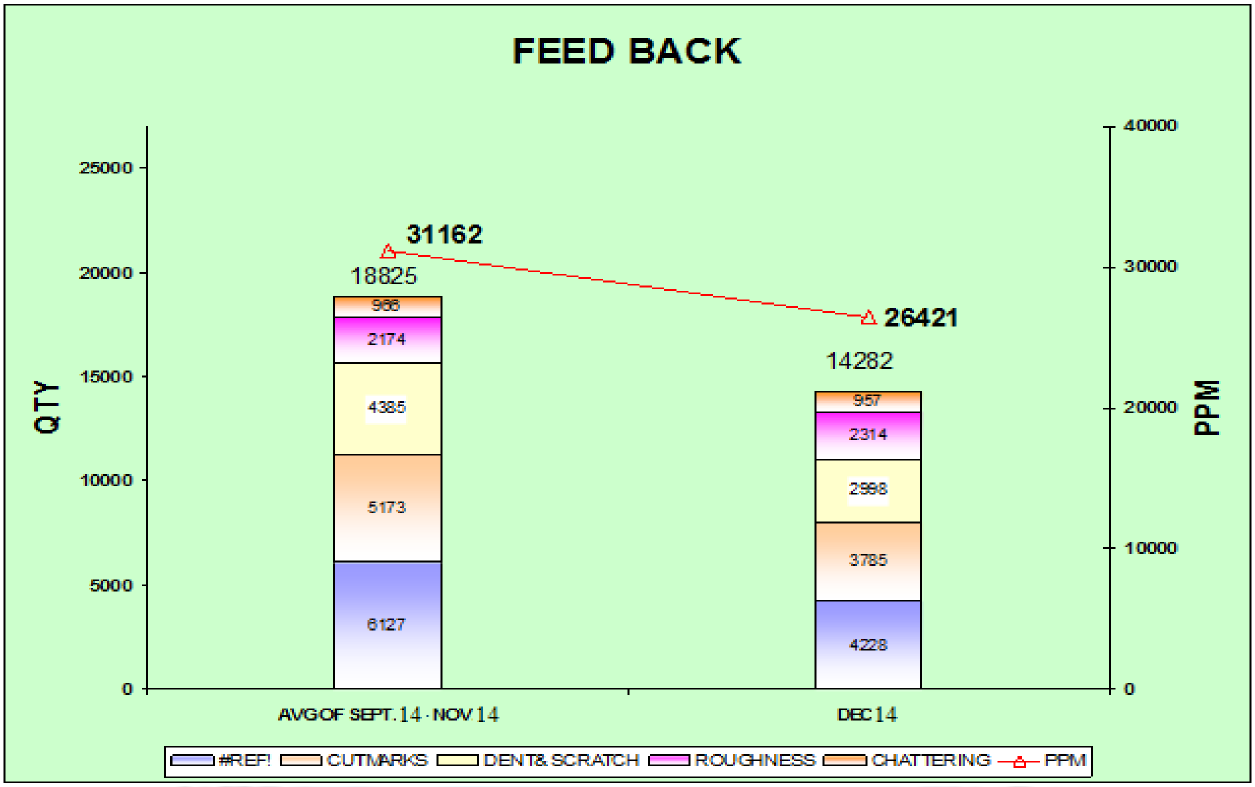

Fig. No. 3.6: Feed back after improvement with histogram

4. RESULTS

The general aim of this paper work is to study the effectiveness and difficulties encountered in the manufacturing company during the production process. Statistical Quality Control techniques implementation and also the major success factors that contribute to the implementation of product quality and less wastage of product and less time consume and better quality product achieved shortly.

4.1.1 Tangible results achieved:

The implementation of SQC have been identified through the abstracting and indexing journals and published or unpublished bibliographies, Academic journals, conference proceedings, books. In this paper shows that questionnaire based survey was conducted in companies of various manufacturers where SQC has been analysis and implement and data collected from the industries was analyzed.

i. The most co- related enablers found from the statistical analysis are Management Support and Training, Quick Change Jaw & Fixture Concept Design and Personnel Involved in Technical Process, Single Minute Exchange of Dies and Personnel Involved in Technical Process.
ii. The most co- related barriers found from the statistical analysis are Lack of Knowledge about Poka-Yoke Methodologies and Breakdown in Process, Discontinuity in Process and Too Expensive, Lack of Training and Difficulty in Change.
iii. The top five ranked enablers found from the statistical analysis are Quality of Raw Materials, Quality Function Development, Management Support, Quick Change Jaw & Fixture Concept Design.
iv. The top five ranked enablers found from the statistical analysis are Complexity in Planning, Technological Error

Wrong Parameters during Implementing, Traditional Way of Working, Too Expensive.

1. Reduced 30% rejection of Fork Pipe.
2. Performance rate Improving.

3. Improving Quality rate.
4. Improving Availability.
5. Improving sales turnover.
6. Improving delivery rate .
7. Reducing breakdown frequency and down time.

Conclusion

Traditional Statistical Quality Control techniques such as hit and trial or thumb rule are not guided by scientific principle or rules but follow an unsystematic approach leading to wastage of time, improper utilization of resources and ineffective solutions. These techniques do not provide optimum solutions but only provide a shortcut whose effectiveness is not guaranteed. Quality Problem Solving Analysis using various quality tools such as Histograms, Frequency Sheets, check sheets, Pareto Chart and Cause and Effect Diagram, it can be concluded that these scientific problem solving techniques are far better and efficient as well as provide systematic approach towards problem solving as compared to traditional quality control techniques used in Indian Industries leading to overall improvement in productivity. Results of case study are follows. :-

1. Improve the machine alignments and grinding roughness.
2. Reduce the 30 % of rejection Fork Pipe. .

Scope for Future Work

In addition to Statistical Quality Control techniques used by us in the given context such as Histograms, Frequency Sheets, Check Sheets, Pareto chart and Cause and Effect Diagram we can also apply other quality tools such as Kaizen, Sampling, Control Charts, Affinity Diagram, Brainstorming and Pie Chart, 3G, 5W2H & Hypothesis testing etc. The problems occurring in the industries are vast and require a mix of various quality tools to help us in effectively solving them. Standardization of the tools according to a specific problem can be done so that specific sets of the quality tools in a proper sequence can be made to be used again in the future on the occurrence of the problem in a different context.

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