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To Analyze the Use of Statistical Tool/S for Cost Effectiveness and Quality of Products

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Abstract: *Companies can lose money because they fail to use significant opportunities to improve product quality as well as product cost. In order to survive in a competitive market, reduce cost of product by improving the quality and productivity of product is must for any company.*
The objective of this study is to provide system/instructions and methodology to reduce cost of product by implementing statistical tools in local plastic injection molding company. Injection molding Company deployed some part of the "Seven Basic Tools" to improve the quality of the product used by our society and reduce cost of the product. Companies may reluctant to their quality status and customer satisfactory status without implementing any helping tool which may reduce cost by identifying and decreasing number of defects and consequently improving product quality and productivity of the system/process. Statistical techniques like "Seven Basic Statistical Tools" (SPC) provides a very valuable and cost effective way to meet these objectives.
The principle aim of this study is to train quality personnel that how to use these SPC tools and exploit these data in Pareto analysis, control Chart, Cause & Effect Diagram and histogram analysis. The causes of non-conformity and root causes of quality problems were specified and possible remedies were proposed to organization to overcome their problems. Some significant Improvement was also observed after SPC implementation in Process potential capability (Cp), Process Actual Capability (Cpk) and Defective parts per million (DPM).
Keywords: *Quality, Statistical Process Control, Defects and Defective, Control Chart, Root Cause Analysis*

I. Introduction

1.1 The Company profile

A local Plastic injection molding company belongs to a large group of companies. The group is in business since 1980's. These five decades of operational excellence, experience and expertise have all formed a combined strength to empower the group as a leading name in PET resin and PET Preforms in Pakistan. The group employee more than 15000 people in the country, in which company have more than 2000 employees. Specially in Injection molding department over 200 employees related to production area.

1.2 Background of the Study

Quality is the concept whose definition has changed overtime. In the past, quality meant the degree to which a set of inherent characteristics that fulfill requirements or conformance to product requirements (Rami Hikmat Found, Adnan Mukattash, 2010). Statistical Process Control (SPC) is a technique used to improve ongoing system process capability. Pareto Diagram, Check Sheet, Histogram, Process Flow Diagram, Scatter diagram are the main tools of SPC. (Rami Hikmat Found, Adnan Mukattash, 2010).

Quality improvement methods can be applied to any area within the company or organization, including manufacturing, process development, engineering design, finance and accounting, marketing and field service of products. To achieve quality improvement in the organization most of the researcher used statistical techniques. Companies can lose money because they fail to use significant opportunities to reduce their costs of quality. In order to survive in a competitive market, reduce cost of product by improving the quality and productivity of product or process is must for any company. Important factors have been identified by researchers which are used in one of research study that contribute to a successful quality programs implementation in manufacturing environment. (Jafri Mohd Rohani,Chan Kok Teng, 2001).

A research work has been carried out to improve the efficiency of the process and product by using process capability analysis. Research work carried out both theoretical and experimental. (Aysun Sagbas, 2009).

Prevention of Non conforming product, Prioritization, Continual Improvement of the Process, Identify the direction of Improvement, Communication, and Auditing of quality system are the six major areas which have been identified in research for process capability application.(Kane, 1986).

One of the researches on same topic has been carried out in local injection Molding Company that also specialized in producing PET preforms, in which they used different SPC tools to highlight their technical problems of production area. This research is about the use of statistical methods and others problem solving techniques to improve the quality of the products used by our society. These products consist of manufacturing goods such as PET preform Bottles and PET Chips (Jafri Mohd Rohani,Chan Kok Teng, 2001).

1.2.1 Problems Encountered during the implementation Stages

Determination of critical Parameters: It is very critical to choose wrong parameter at the initial stage of the study which jeopardizes the whole success of the SPC implementation.

Lack of Past Data: Some time organizations do not have past data or existing data. This eliminates the chance of getting general idea about the history of the process during the process evaluation stage.

Not Enough Data: Statistical analysis heavily relies of number of data points used in the analysis during the study. But it is very hard to commit employees to collecting an extensive amount of data.
(Sezia Dogdu, Dr. D.L Santos, Tim Dougherty, 1997)

Above mentioned all problems are very important to carry out research but in our context, the major problem is the determination of critical parameter. So in this study we first find out critical parameter by using statistical tools.

In order to survive in a competitive market, Reduced cost of product by improving quality and productivity of product or process is mandatory for any company. Statistical tools provide a valuable and cost effective way to produce lower cost and better quality product. If the quality of the product is improved, it also means lower defect rate and improvement in productivity.

It is known most of the Pakistani industries are not aware statistical techniques and their benefits. This is the reasons for pursuing this study to develop awareness of statistical process control tools for company's employees and how the cost of product can be reduced by using these techniques.

The cost of quality is not confined to cost related to process assurance, product inspection, rework and rejects; rather it encompasses the impact on performance and market perception for the product . In the global economy, multiple organizations collaborate to deliver a product to the end customer.

Based on the above facts, following research problems have been developed on implementation of Statistical process control in local plastic injection molding company to improve the quality of the product as well as reduce its cost.

To address the research problem, number of research activities have been planned, Critical defects in specified time period to be identified in first Phase, in second phase finding out the process capability to measure the performance of the process. In third phase analyze a special cause of variation by using control chart, and finally give action plan to top management to overcome these problems.

The aim of this study is to train personnel in the area of quality control that how to use these SPC tools. The critical cause of non conformities and their root cause of the product problem will be identified and action plan will be given to organization to overcome their critical problems.

II. Literature Review

Quality has been an important issue for organizations specially for manufacturing industries for many years. There have been many quality initiates over the past decades. Like quality circle, Statistical Process Control. Total Quality management, ISO standardization, Malcolm Beldridge National Quality Award, Prime Minister Quality Award (Pakistan), Kaizen etc. Organization which implemented the above initiated specially Statistical Process Control (SPC) have benefited financially by reduction of quality defects and reduction of customer complaints.

In the 1920's , Walter Shewhert was the first men to developed Statistical application and control Charts in Industry . This method was different from previous method since it allowed for monitor and control of product and process quality and known as Statistical Process Control (SPC).(Wotman, et al, 2007)

Sabgbas, 2008 chosen manufacturing industry to conducted the research on topic “Improving the process capability of turning operation by the application of Statistical tools”. He used process capability and histogram tools to analyze the data. In this study a process capability analysis have been carried out in the machining line of medium size company that produces machines and spare parts. Cp and Cpk indices were calculated in this study and determine that if you want to improve quality level by shifting the process mean to the target value and reduce the variation by using process capability measure , you have to evaluate Cp and Cpk value which shows the overall process performance indicators.

Usamn, kontagona, 2012, conducted their research on “Statistical process control on production“. In this research the main focused on some of the basic chemicals used in pure water production and check parameters such as Ph, conductivity, Lead (Pb), Aluminum (Al) and Chloride (cl). They used control charts to identify the special cause of variation during different parameters tests. Most of the test shows that chemicals used are out of process control.

Rohani, Teng, 2001, conducted their research on "Improving quality with basic statistical process control tools". In this research, some of the basic SPC tools deployed in local plastic injection molding company to find out the critical defects by using Pareto chart analysis .After implementation of SPC tools, defects decreases from 13.49% to 7.4%.

Benneyan, lloyd, Plsek, 2003, chooses healthcare industry to conduct their research on statistical Process Control as a tool for research and health care improvements. They determine that SPC and its primary tools the control chart provide researchers and practitioners with methods of better understanding and communicating data from health care improvement methods. They also use time series analysis methods with graphical presentation of data in their research study.

Fouad, Mukattash, 2010, chosen Jordanian industry to implement statistical process control tool to conduct their research on topic "A practical guide for Jordan industrial organization". In this research they focused Jordan manufacturing company that specialized in producing steel and monitor real life data by using statistical process control tools. The main objective of this study is to maximize profit by improving product quality, improving productivity and reducing defects by implementing SPC tools. They first identify the critical defects of the process and then find out the root cause of nonconformities and proposed possible remedies to overcome the problems.

Dogdu, Santos and Dougherty, 1997, conducted their research on "Guideline for implementing statistical process control in printed circuit board manufacturing". This study focused training and implementation procedure of statistical process control techniques at a printed circuit board manufacturing facility. They also discussed different statistical tools like gauge R&R capability indices, application of spread sheet for analysis of repeatability and reproducibility and design of experiments (DOE).

Timmweman, verrall, Elatney, Klomp, Teare, 2010, conducted their research on "Using statistical process control to identify the patterns of improvements in a quality improvements collaborative" The objective of this research study to identify the variation in Saskatchewan chronic disease with the help of line graph and statistical process control tools. In this study they used line graph and regression analysis to determine improvement level among practices.

Wooddall, 2000, conducted their research on "Controversies and contradictions in statistical process control" some of controversial issue have been discussed in this study and also highlighted some of the contradictory positions held by past and presents leaders. End of the study, researcher offered a solution of some of these disagreements in order to improve the communication between practitioner and researchers.

Young, Bond, and Wiedabak , 2007, have conducted research at four hardwood sawmills in the united states over a five year time period. The study showed that the use of real time SPC leads to target size reduction, variation reduction, improved lumber recovery, and improved financial performance.

Timothy M Young, Brian H Bond, and Jan Wiedabak have covered Quality as well as Cost Impact in their research work having title "Implementation of real time statistical process control system in hardwood sawmills ". but they used only MEAN, MEDIAN, and S.D tools to find out the cost of the product.

So, after gone through more than 50 research articles, It was decided to chose some basic statistical tools like Pareto diagram, Control Chart, Histogram for our research to to improve the overall process performance.

2.1 Seven Basic Tools

Most of the companies use some of "Seven basic quality tools" in their companies for problem solving purpose.

Total Quality management tools and techniques divided into two categories of quantitative and non quantitative. Quantitative technique are known as Statistical Process Control and non- quantitative are known as Kaizen, lean manufacturing, ISO, TQM, etc.

SPC often called magnificent Seven " SPC normally comprised of seven basic tools like, Pareto Chart, histogram, Check Sheet, Control Charts, Cause & effect diagram, Scatter diagram and process flow chart. (Rami Hikma Fouad, Adnan Mukattash, 2010)

There are a considerable theoretical and experimental research work on improving product quality and process efficiency by using process capability analysis. Cp, Cpk, Cpm are three main process capability indices and also proposed in manufacturing industry to provide a quick identification of how well yours process is performing according to your target specification. To measure the product qualities and process performance that meet target specification in manufacturing industries by using process capability indices. To require a certain quality from vendor/supplier, the customer determines a specification limit or tolerance limit by setting lower and upper specification limit. There are several capability indices including Cp, Cpk, Cpm.

The index Cp talks about the overall potential capability of the process by considering lower and upper specification limits (Ayson Sagbas, 2008).

To detect special cause of variation, we use variable control charts rather than attribute control chart. Variables charts typically used in pairs like mean and range chart, mean and stand. Deviation chart. One chart study the variation in the process and other study the process average. One of the most commonly pair of charts is the X-bar and R-chart. (Rami Hikamt Fouad, Adnan Mukatesh, 2010).

Attribute control charts used when characteristics are defects, yes/No situation, success/failure.

For collection of data, the first step is to developed check sheet. The main purpose of check sheet is collect accurate and precise data by operating persons(Besterfield).

The main purpose of Pareto analysis,

"Vital Few from trivial many"

Pareto analysis is depending upon 80-20 rule , which describe 80% of the problem would occurs due to 20% of causes .

A frequency chart simply a frequency distribution (like histogram) arranged by categories of attribute data. Categories of responses and frequency of responses are listed on X-axis and Y-axis respectively.(descending order largest to smallest order) and a cumulative percentage of responses are shown on the right side of Y-axis (Rami Hikamt Fouad, Adnan Mukatesh, 2010).

Cause and effect diagram generally known as " Root Cause analysis" of the problem. Problem solving normally follows six steps

- Define the problem
- gather data of information
- list down all possible solutions
- test solutions
- select the best course of action
- implement the proffered solution

However, before ewe solve the problems, we should clear as to what is causing it ....The ROOT CAUSE.
A root cause is one where,

The problem would not have occurred if the cause had not existed.

The problem will not re-occur if we correct or remove this cause. And the root cause analysis is the process of findings the root cause of the problem

This technique is very important because sometimes we make changes that simply address the symptoms of the real problem because we have not identifies the root cause. If we do this, this problem will re-surface.

Five -why technique normally use for root cause analysis to detect any root cause of problem. This is a technique aimed to moving beyond symptoms to the root cause of the problems In cause and effect diagram, It is important to explore all of the things that could cause it, before you start to think about a solution.

III. Data Analysis, Interpretation Of The Results And Discussion

In this research, collection of data over a period of three months based on daily check sheet from a machines from injection molding department, which includes the quantity output of goods parts and defective parts.

1. Collection of data from production line of PET preform of Machines.
2. Prepared Pareto Diagram of Defect Data.
3. Identify critical defects.
4. Find out root causes by using Cause and effect analysis of critical defects
5. Prepare a control chart to distinguish between assignable cause variation and common cause variation operator wise.
6. Prepare a histogram to evaluate Potential Process Capability, and Actual Process Capability between operators.

The company collected a data over a period of three months based on monthly check sheet which include Machine No, gramge details, total production in terms of pieces and kgs both, total Hold, rejection after segregation and types of defects are shown in **Table -1**

Based on information in **Table-1**, a Pareto chart was constructed to identify the most critical defects as shown in **Figure-1.**

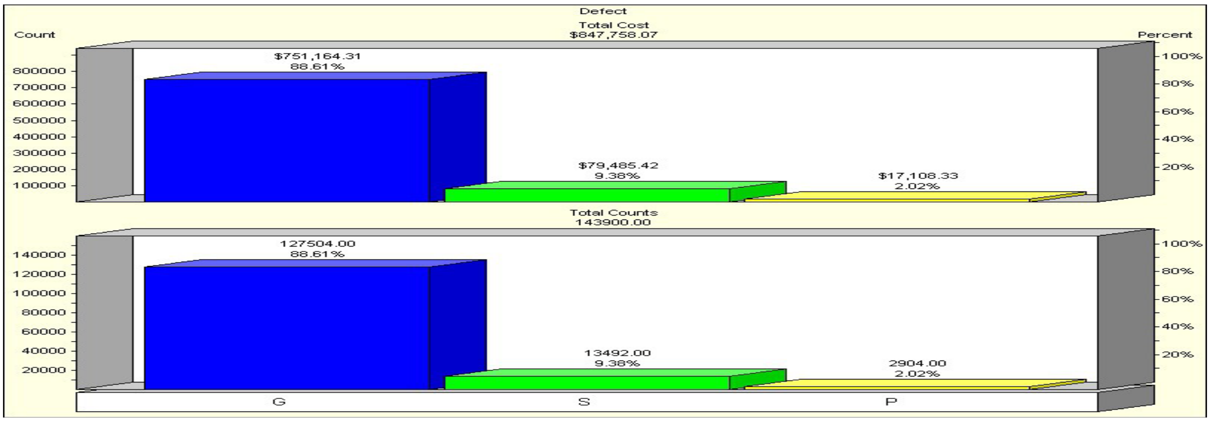
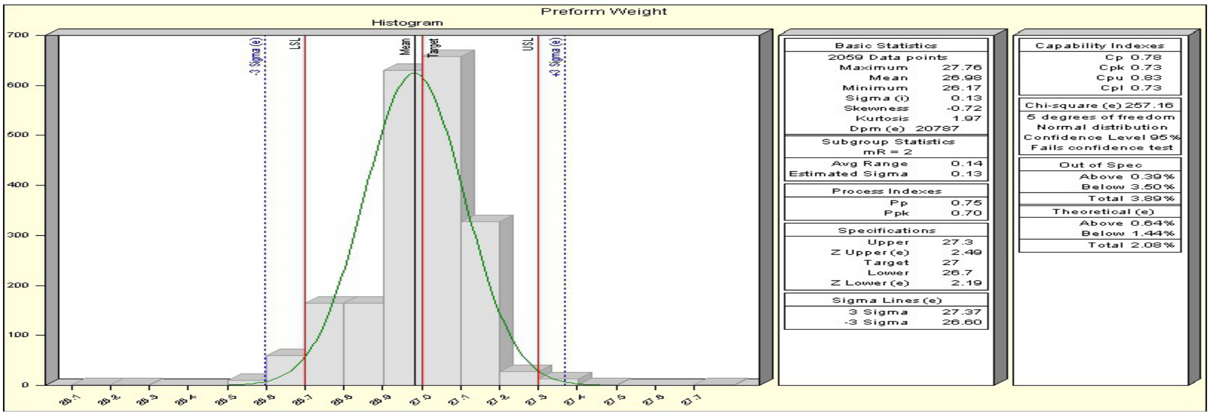


Figure-1 (Top part) revealed that *GATE PIN HOLE* is the only highest cost with Rs. 751,164/-, SSV with Rs. 79,485/- and PARTING LINE with Rs. 17,108/- having total cost of these three defects are Rs. 847,758/-.

Figure-1(Bottom part) revealed that *GATE PIN HOLE* is the highest defects with average of 88.6%, *SSV* (Selling surface variation) with average of 9.37% and *PARTING LINE* with Average of 2.01%.

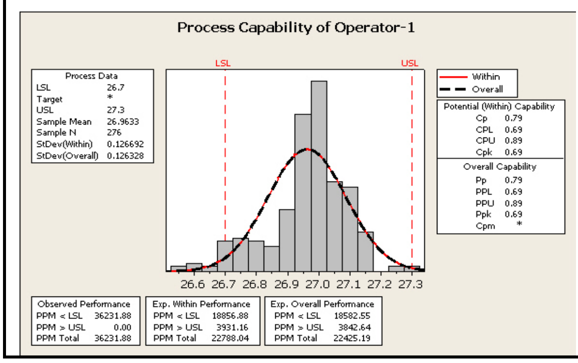
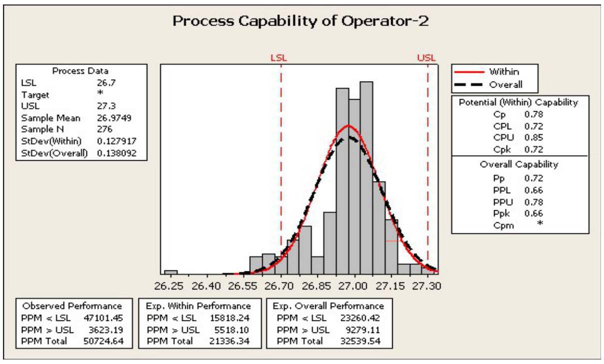


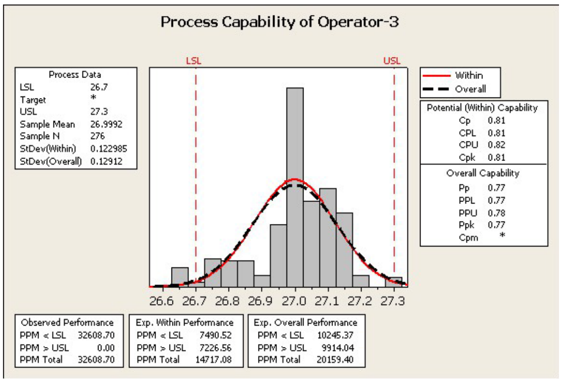
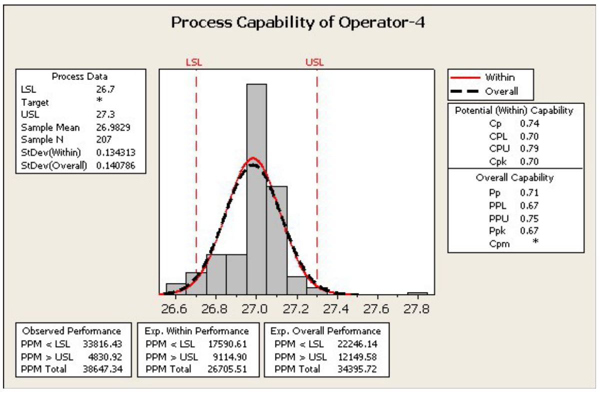
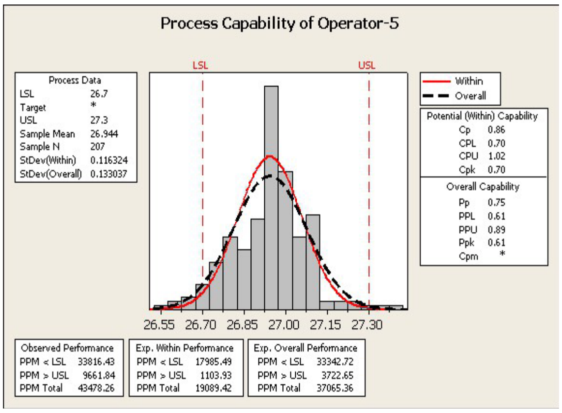
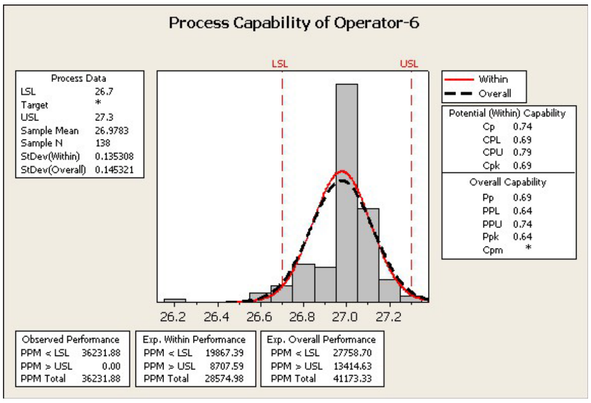
Based on information in attached table-1, a histogram was constructed to identify potential capability of the process. Figure-2 showing **Cp=0.78** value, which showing that process is not capable to produce good products as **Cpk=0.73** on the lower side.

Histogram also showing, direction of the process towards at lower side. Some of the values laying out side lower specification, which also decrease the the Cp and Cpk value. If we wanted to improve Cp and Cpk value, we need to centralize process mean.

Figure -2 also revealed that if we do not adjust process, process will produce **20787** (Dpm value) expected defects (in one million) in future. **20878** defects cost becomes **Rs.122,435/-** in one million preform.

3.1 Operator Wise Process Capability

OPERATOR -1	OPERATOR -2
	

OPERATOR -3	OPERATOR -4
	
OPERATOR -5	**OPERATOR -6**
	

Operator -1 Histogram revealed that, some of the values are laying out side both upper and lower specification limit. Cp= 0.79 showing weak potential capability and Cpk =0.69 also showing process need to adjust their process mean toward center. PPM (expected) value at higher side as 22788 defective parts because of weak Cp and Cpk value. PPM at lower side showing 18856 and at upper side showing 3931, which also shows that, process need to be adjust from lower side toward center.

Operator -2 Histogram revealed that, some of the weighted values are laying out side both upper and lower specification limit. Cp= 0.78 showing weak potential capability and Cpk =0.72 also showing process need to adjust their process mean toward center. PPM (expected) value at higher side as 21336 defective parts because of weak Cp and Cpk value.
PPM at lower side showing 15818 and at upper side showing 5518, which also revealed that, process need to be adjust from lower side toward center.

Operator -3 Histogram revealed that, some of the weight values are laying out side both upper and lower specification limit. Cp= 0.81 showing weak potential capability and Cpk =0.81 showing process adjust within center but need to minimize deviation as process showing large spread. PPM (expected) value at higher side as 14717 defective parts because of weak Cp.
PPM at lower side showing 7490 and at upper side showing 7226, which also revealed that, process need to adjust their spread from both upper and lower side.

Operator -4 Histogram revealed that, some of the weight values are laying out side both upper and lower specification limit. Histogram also showing outlier from upper side which need to be investigate. Cp= 0.74 and Cpk = .70 showing weak potential capability. PPM (expected) value at higher side as 26705 defective parts because of weak Cp and Cpk value. PPM at lower side showing 17590 and at upper side showing 9114, which also revealed that, process need to be adjust from lower side toward center.
Operator -5 Histogram revealed that, some of the weight values are laying out side both upper and lower specification limit. Cp= 0.86 showing weak potential capability and Cpk =0.70 showing process need to adjust

within center and minimize deviation as process showing large spread. PPM (expected) value at higher side as 19089 defective parts because of weak Cp and Cpk value. PPM at lower side showing 17985 and at upper side showing 1103, which also revealed that, process need to adjust their spread from both upper and lower side.

Operator -6 Histogram revealed that, some of the weight values are laying out side both upper and lower specification limit. Histogram also shows that, outlier found at lower side which need to be investigate. Cp= 0.74 showing weak potential capability and Cpk =0.69 howing process adjusted within center however process deviation require to control as spread was large.
PPM (expected) value at higher side as 28574 defective parts because of weak Cp and Cpk value. PPM at lower side showing 19867 and at upper side showing 8707, which also revealed that, process need to adjust their spread from lower side.

Operators	Opert-1	Opert-2	Opert-3	Opert-4	Opert-5	Opert-6
Process Capability (Cp)	0.78	0.78	0.81	0.74	0.86	0.74
Actual Capability (Cpk)	0.61	0.72	0.81	0.7	0.7	0.69
Defective parts per Million (DPM)	36231	50724	32608	38647	43478	36231

Table -02 shows the comparison of process capability (Cp) within Operators, which revealed that none of the operator having large Cp value as highest Cp value is 0.86 of operator -5. if we improve operator process performance by capability indices then our overall process performance will automatically improved.

Table -02 shows the comparison of Actual process capability (Cpk) within Operators (which should be closed as possible with Cp value), which revealed that none of the operator having large Cpk value as highest Cpk value is 0.81 of operator -2. if we improve operator process performance by capability indices then our overall process performance will automatically improved.

3.2 Control Chart Comparison With In Operator's

Control Chart of weight of preform (Figure -03) also constructed to support previous statements regarding most of the values were laying outside the lower control control limits.

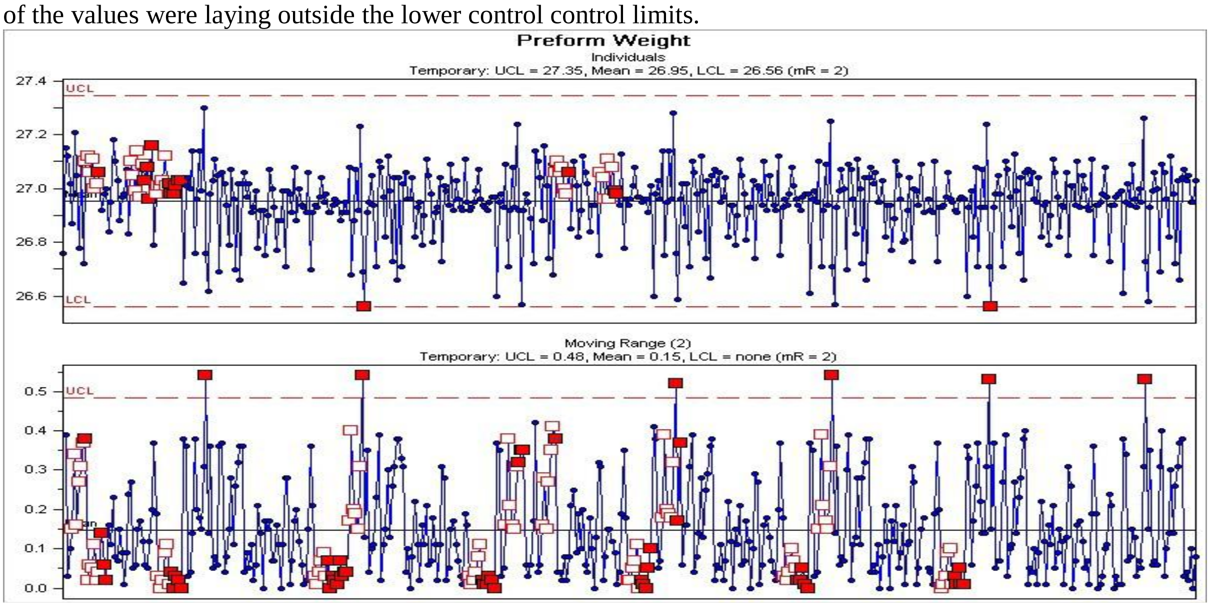


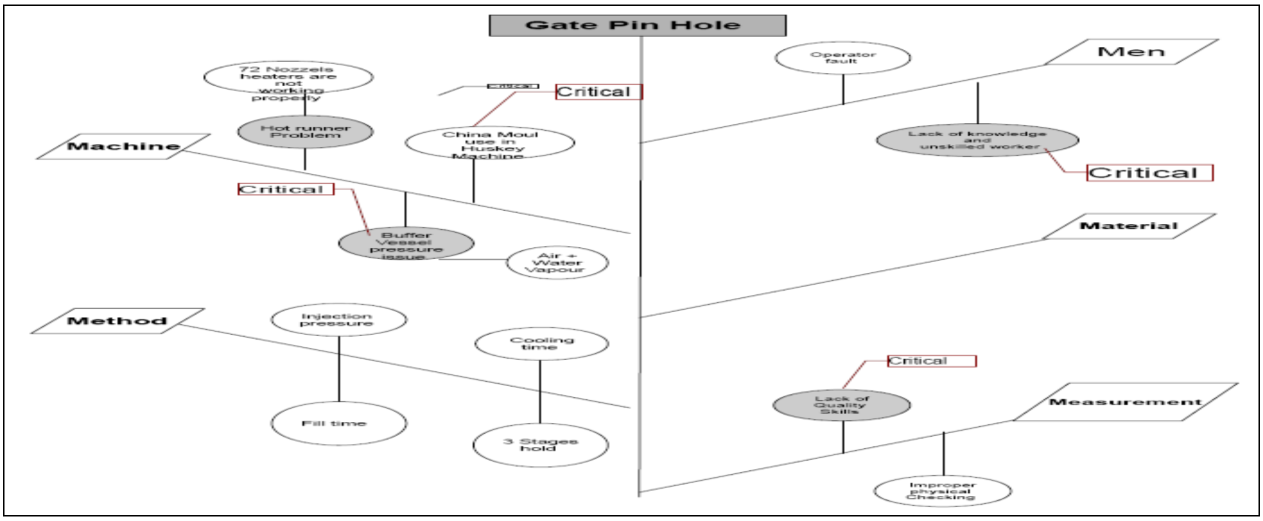
Figure -03 revealed that, special cause of variation are present in both X-bar and S Chart & some clusters at lower side also indicating out of control, those are also highlighted with red color. If we control special cause of variation, we can improve our Cp and Cpk value, which will also reduce the no of defects.
Special cause of variation could be, because of operator negligence, operator not competent, lack of skills labors or machine behavior at specific intervals. So we need to focus on these areas to reduce special cause of variation in the process.

Here is the brief summary in table -03 regarding control chart comparison between operators

Operator Details	X-bar	S Chart	Over all Remarks
Operator-1	Most of the points are out of Control Limit	2 points are out control limit	Indicating Out of control
Operator-2	Most of the points are out of Control Limit	5 points indicating out of control	Indicating Out of Control
Operator-3	Most of the points are out of Control Limit	Most of the points are out of Control Limit	Indicating Out of Control
Operator-4	Most of the points are out of Control Limit	Most of the points are laying on below Control Limit	Indicating Out of Control
Operator-5	5 points are out of control limit	S chart look in control	If we exclude 5 points, our process expected to be in control
Operator-6	8 points are out of control limit	Most of the points are laying on below Control Limit	Indicating Out of Control

3.3 Root Cause Analysis For Defects

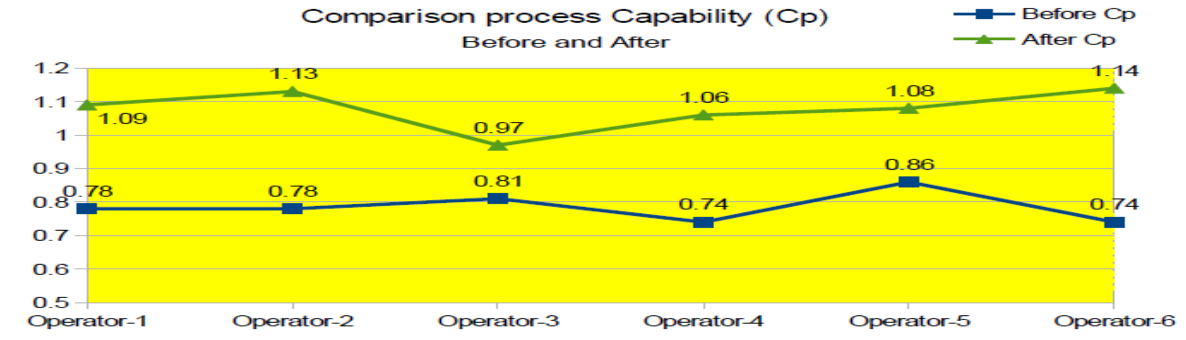
As we have find out the most critical parameter is *gate pin hole defect* during above study through Pareto analysis, so we prepared cause and effect diagram to find out the potential causes of this defects



3.4 Improvement Action Plan

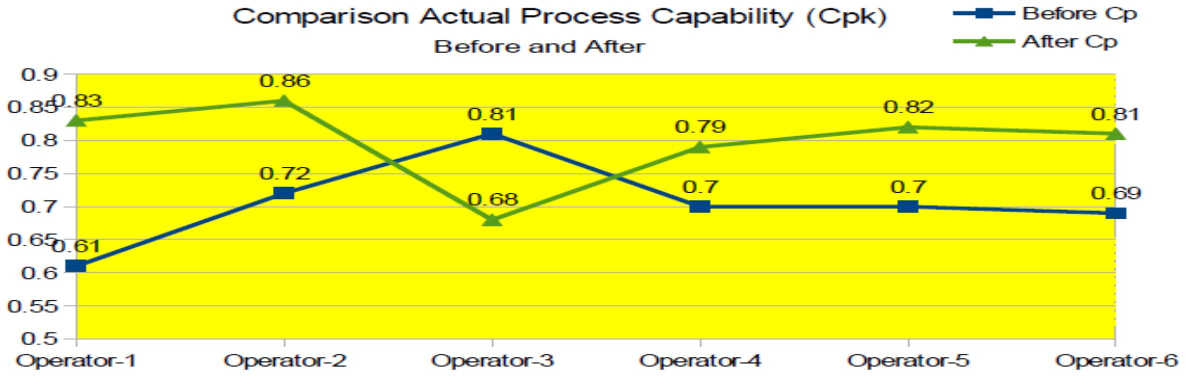
Description / Action Plan	Critical/ Non critical	Potential Causes	Type
-To improve worker skills - Display work instructions and procedure to guide worker -Orientation program for new induct worker	Critical	Lack of knowledge and unskilled worker	**MEN**
Because of hot runner problem, nozzle tip temperature too high, Adjust Nozzle and tip Temperature Display work instruction for adjustment of Nozzle and tip temperature.	Critical	Hot Runner problem	**MACHINE**
Air + Water vapor becomes due to buffer vessel, Adjust buffer vessel pressure Display work instruction for adjustment of buffer vessel	Critical	Buffer Vessel pressure	**WORK METHOD**
Machine must always ensure correct injection pressure, cooling time, 3 stages hold and filling time .	Not Critical	Injection Pressure	**WORK METHOD**
- Quality personnel must be trained - Must have details defects knowledge - must have skills to identify physical preform defect	Critical	Lack of quality skills	**Measurements**
Environment must be clean	Not Critical		**Environment**

3.5 Operator Wise Process Capability (After Improvements)



Here is the comparison of process capability before and after implementation of SPC tool in injection molding department. You can see that blue line indicating improvement before SPC implementation and Green line shows improvement after SPC implementation.

In Cp analysis Table - clearly revealed that process have been improved rapidly after SPC implementation specially in operator -6 (increased upto 29%) which Cp value was 0.74 and after SPC implementation reaches to 1.14 which is close to 1.33 scale.



Here is the comparison of Actual process capability (Cpk) before and after implementation of SPC tool in injection molding department. You can see that blue line indicating improvement before SPC implementation and Green line shows improvement after SPC implementation.

Table - clearly revealed that process have been improved rapidly after SPC implementation especially in operator -1 (increased upto 16%) which Cpk value was 0.61 and after SPC implementation its reaches to 0.83, although more improvement are required to achieve 1.33 standard scale.

Operator-3 Showing decreasing trend which could be because of some special causes are present in the process due to machine or worker, which also need to be investigate in future through control chart analysis.

Here is the comparison of expected Defective Parts Per million (DPM) before and after implementation of SPC tool in injection molding department. You can see that blue line indicating improvement before SPC implementation and Red line shows improvement after SPC implementation.

Table - clearly revealed that process have been improved rapidly as DPM value decreases after SPC implementation specially in operator -2 which DPM value was 50742 and after SPC implementation its reaches to 5039, although more improvement are required to reduce Defective parts per million.

Figure also shows that, minimum DPM at Operator-2 which also has large Cpk value, which is showing that if we increased Cpk value DPM rate will decrease automatically.

IV. Conclusion, Recommendation, Future Research And Development.

In recent pas years, Statistical process control analysis has become an important part for quality improvement and its application in an organization. The Pareto analysis , control chart, and process capability, which are SPC techniques, helps to determine the ability for manufacturing between specification limits (Voice of Customer) and control limits (Voice of the process).

In this research a few of the seven basic QC tools had been used for quality improvements activities for example,

a) Control Chart had been used to monitor a process variation as well identification of special cause of variation which were treated as a common part of the process.

b) Histogram had been used to identify the capability of the process as well as expected number of defects in current position.
c) Pareto chart had been used to identify the most critical defects in terms of numbers and as well as cost.
d) Process capability analysis had been carried out for the elimination of the quality problems during preform production.

In this study, number of non-conforming parts were identified in short period of time, for the elimination of quality problems and improve process capability, action plan was given to company's top management to overcome these problem. Data collected showed some significant improvement in process capability as detail was given in Table-3.

Refer to Table-3,

- Refer to Table * 6 Process capability (Cp) for operator-1, operator-2, operator-3, operator-4, operator-5, and operator-6, improved 24%, 27%, 12%, 23%, 16%, and 29%respectively.

Refer to Table * 6 Actual process capability (Cpk) for operator-1, operator-2, operator-4, operator-5, and operator-6, improved 16%, 10%, 6%, 9%, and 9% respectively.

Refer to Table * 6 Defective parts per million (DPM) also significantly reduced due improvement was observed in actual process capability.

Hence the statistical tools are powerful, user friendly process analysis tools that can be used by practitioners and researcher for quality improvements. These tools can also help practitioner, process managers to make appropriate decision making to use objective data and statistical thinking.

This study has achieved its goal . It is noted that some simple statistical tools can make significant improvement to the company. Some future improvements plan that had been suggested and recommended to top management of the company.

1. Operator is advised to be more careful on their handling to prevent defects, caused by Human error
2. Critical defect had been find out in this study, now by using scatter diagram find out relationship for these critical defects with production parameter. Which are caused for these types of defects. Scatter diagram will helps us to build relationship between two variables.
3. Preform weight is used in this study for data analysis, now organization should use basic SPC tools for other parameter like I.V, down time of machine etc.
4. Data of Machine # 03 is used during this entire study, now organization should also analyze same type of study on other machines data to find out the trend and process variations.
5. During this research, we struggle to collect appropriate data, to avoid this non convenience check sheet will also be modified as we suggested molding staff during our visit.
6. Basic SPC training is required for department lower staff workers.
7. In this study we have found the relationship between Actual process capability and defective parts per million, now Correlation diagram will also helps to validate this result.
8. Proper training for operational handling, and basic maintenance should be arranged for operators.

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