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Research Article

A STUDY ON TECHNIQUES USED IN STATISTICAL PROCESS CONTROL FOR BATCH MANUFACTURING

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A B S T R A C T

Today's demand about any products or processes is Quality. The organizations holds better command on Quality grows more as compare to other. The engineers does their job for the process improvement. Today, it is required to keep up any production process within certain limits. The variation in process will result in failure of rate of production which especially impacts on cost associated with manufacturing. The failure of process will straight forwardly impacts on financial development of company.
The paper presents the study on Statistical Process Control (SPC) and its tools required for the determination of process performance, process capability to develop process superior than previous. The improvement in process leads to profit in manufacturing processes. Here some tools has explained for study and analyzing the process behavior.

INTRODUCTION

As rapid development of the production technology, customers require their products be high quality with very low parts having nonconformities. This is right, particularly, for high technology items requiring low fraction of nonconformities, often measured in PPM (parts per million). Traditional methods for obtaining fraction of nonconformities become non reliable for those high quality processes. Since any produced item of reasonable sizelikely contains no defective product items.

It was seen that skilled worker adjust the product design for production. He make some changes required for suitable production but, the supplier demanded all products in certain limit known as specification limit. Thus, there is need of improvement in product and process development. The process may be considered in any action taken for some output.

This paper deals with theoretical view on process control and explanation of techniques used in SPC. Several tools have discussed in this paper such as X-bar Chart, R-Chart and histogram. This tools are most commonly used in engineering industries however, this tools are largely important in batch manufacturing like automotive parts.

LITERATURE REVIEW

As fast improvements in the manufacturing system, end users need their products begood quality with very less fractions of defectives.

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Traditional methods for determining defectives become inapplicable for those high-quality processes because any manufacturing sample of specific size likely contains zero defective products. An alternative approach based on Process Capability Indices for determining quality ofmanufacturing process, especially for automotive product requiring very defectives (Measured in PPM, parts per million). The manufacturing associates can use thepresented approach to determine quality testing and measure whether their processesare capable for reproducing products satisfying customers. [1]

A falling of typicalprocesses results in inapplicable process behavior. New challenge arises forprocess quality inspection based on the dimension of the products which needsmicroscopic measurments for effective quality control. A model containing characteristics of quality testing and general process variables allows theaccuracy of the process performance. The quality control strategy considerablyto the properties of the production process and the properties of the qualitytesting using SPC allows good results than just oberving at them in general. To avoidthe limits of a unidirectional measurement system a combination of different SPCwill further improve the overall quality. [2]

Target values for the capture factor are in the scope of 97 - 99% for average working conditions. These values must be come to if suitable quality details are satisfied. Specification values are recommended and their suggestions on catch factors are examined in view of the well-observed Statistical calculation model. An assignment of measurement techniques which can be connected for measureand control of the

geometry parameters. It permits the identification of geometrical defects, and counter measures to improve the product quality and performancecan be actualized. The prescribed quality confirmation approach is proposed for execution in manufacturing industry, construction projects, prompting enhancedyield and better financial process performance. [3]

The Application of techniques of SPC, through which achieve continuous quality improvement. The profit of these tools is that they can identify the effects ofthe processes that cause variability in processes that result of poor quality. Techniques like Process Capability Index, Histogram, and DMAICmodel, and control chart, etc. can reliably measure the variation in the process and thereby contribute to quality improvement. Histograms show the contribution of the normal distribution of frequencies identified quality characteristics while Shewhart control charts show that the investigated processes areunder Statistical Control. Use of DMAIC model as well as other statistical qualitytools is a way to achieve continuous quality improvement. [4]

The SPC and the DMAIC model as tools for continuous quality development. It was confirmed that with Shewhart control charts, capability indexes, histograms can befor controlling variation in the process in order to be filled with the requirements ofthe vendors. Addition of new ideas into the system of commonly accepted SPC knowledge has been much too slow and has led too much of the criticism regarding the relevance of SPC in the current manufacturing. [5]

A proposal of the implementation of the technology 'Six sigma' for the assurance and development of the quality of selected production processes in manufacturing with a changing degree of the Quality Management System and developing the quality of the processesin the manufacturing. The stage of quality assurance and development of products and services is considered an important way of improving the competitiveness of industries. Typical project outputs provide way for quality improvement. [6]

Typical techniques such as Statistical Process Control (SPC) and Process Capability Analysis (PCA) that produces the Statistical Quality Control (SQC) can be used to determine special causes of variation. The Functional Data Analysis (FDA), have been used successfully in this discussion to study these phenomena insituations where the classic quality control cannot. Control Charts can be used successfully in the search and elimination of outliers. When data don't follow anormal distribution, Functional Data Analysis can be applied effectively in the detection of outliers, also contributing major advantages in the detection of typical variation compared to historical techniques such as SPC. [7]

Statistical Process Control(SPC) is a technology used for measuring and minimizing the variation inprocesses and the main tools of SPC are Control Charts. Normally, SPC works under the consideration that observed data is not dependent. However, because of the advanced inspection technique, shortened sampling interval and the nature of processes, especially in continuous processes, the independence of each observation has been violated in many ideas. The different categories of stationary need a different chart design and it will facilitate the application of practitioners when the process is auto correlated. According to the results, the selection of appropriate control charts will assist engineers to measure the auto correlated processes effectively. [8]

METHODOLOGY

The present study includes the co-relationship between Production process Parameters, SPC Parameters and Manufacturing Cost. The literature tells that there is some connectivity between the production parameters and SPC parameters. An approach presented here that the manufacturing cost also related with the combination ofthe production and SPC parameters.

Initially, Trial 1 has taken by selecting certain production parameters for various operations. The produced capacities are inspected for SPC testing and SPC parameters are evaluated. The manufacturing cost also obtained by conventional method. The parameters are shown in table 1. The methodology adopted is shown in figure 1.

Table 1 Successive Trials for SPC

Sr. No.	Trials	Operation	Process performance Parameters		
			Spindle Speed	Feed Rate	Depth of Cut
1	1	Manufacturing	2000	20	2
2	2	Manufacturing	2010	25	3.5
3	3	Manufacturing	2020	30	4

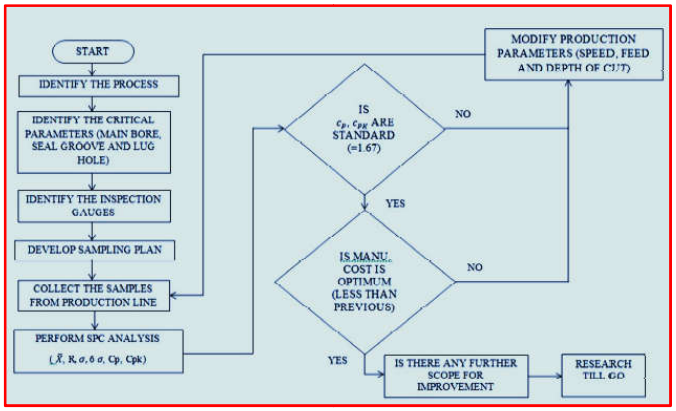

Figure 1 Methodology for Study of Manufacturing and SPC Process

Techniques used in SPC

X-bar Chart: It is also known as Control Chart and shows the average of the process, i.e. it shows the variations available in the average of sample. X -Charts represent the average values of variable. The normal qualities have anability to be the control measurement about which most of alternate measurements are assembled in the way that the example of variety is typical. (Figure 2)

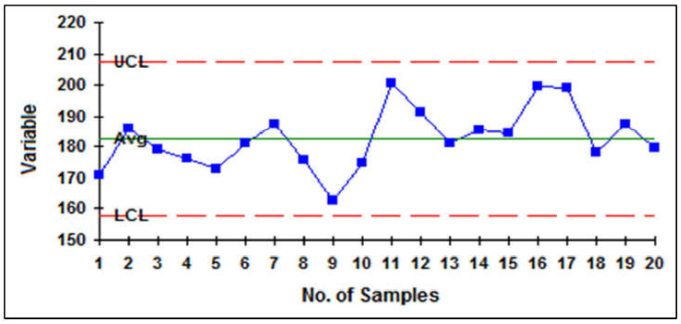

Figure 2 X-bar Chart (Control Chart)

R-Chart: R chart plots the Process Range (R Chart) over time for variables data insubset. This control chart is used to obtain

the capability of processes in many industries. It can used to measure the process variation for subsetsof samples of product. The R Chart is monitored because it should inspect to determine whether the process is capable. Test the R chart first because the process variation must be in limit to correctly inspect the X-bar chart. The control limits of the X-barchart can be determined considering both process spread and center. If the R chart isout of control, then the control limits on the X-bar chart may falsely indicate an out-of-control condition. (Figure 3)

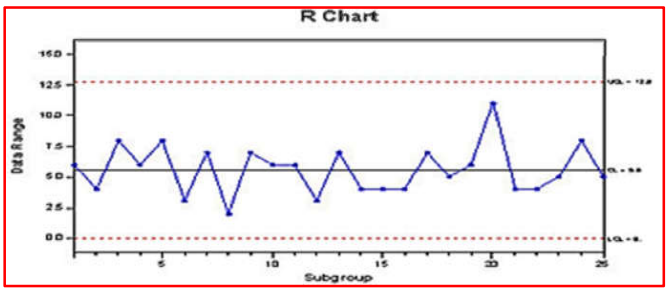

Figure 3 R-Chart

Histogram: it presents a graphical representation of information. In this chart the sides of the section shows the upper and lower limit cell and middle cells denotes the frequency of normal distribution of measuring items. It is expected that, main situation of process should be center of histogram. (Figure 4)

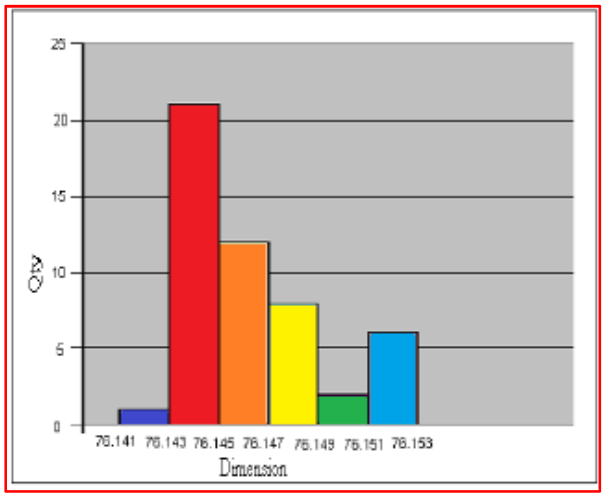

Figure 4 Histogram

CONCLUSION

The present paper includes a review on techniques used in SPC to improve batch production and develop the relationship between process parameters. It draws following statements as outcomes.

1. The batch manufacturing process studied successfully.
2. The SPC department always need to develop.
3. Techniques used in SPC are most useful in determining the capability of product and process.
4. Today's world needs developments in SPC, Production and cost department.

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