

# Review of Statistical Process Control Analysis

Mule Gautamee<sup>1</sup> S.S. Karidkar<sup>2</sup>

<sup>1</sup>M. Tech Research Scholar (Production Engineering) <sup>2</sup>Assistant Professor

<sup>1,2</sup>Department of Mechanical Engineering

<sup>1,2</sup>Kolhapur Institute of Technology's, College of Engineering, Kolhapur, Maharashtra, India

**Abstract**— Broad support for operations is one of the key challenges of modern production organizations' competitive advantage. Statistical Process Control (SPC) is an essential part of support services; using statistical techniques for monitoring and controlling production processes and products. Application of SPC however needs some mathematical knowledge and comprehension. This paper deals with all the literature review analysis and their point of view regarding SPC analysis and some requirement and advantage of SPC analysis.

**Keywords:** SPC (Statistical Process Analysis)

## I. INTRODUCTION

Many companies have become an essential business model for controlling and improving quality; manufacturing companies, suppliers, logistics companies, financial services organizations, healthcare professionals and government entities. Value constitutes a strategic edge. A company which can attract consumers can overpower its rivals by enhancing and monitoring the price.

Broad support for operational activities has been one of the key requirements of modern manufacturing organizations' competitive success. Statistical Process Control (SPC) is an essential part of operational support; using statistical methods for monitoring and controlling manufacturing products and processes.

## II. LITERATURE REVIEW

Ignatio Madanhire et al. [1] Researcher study in industrial processes, mathematical process management device with the specific goal of updating them to improve efficiency and cost effectiveness. It reflects an effort to resolve the shortcoming in applying SPC literature. SPC was seen to have a distinct benefit over safety approaches such as end product testing, with focus on early identification and avoidance of the problems. There was a need to inspect gages and equipment, and to assess the need to conduct any repair or redesign work because defective machinery could not deliver high quality goods. And he concludes that "Quite a few companies have been at different stages of implementing SPC in an effort to meet their competition by using these quality control tools. The test sheets and flow charts were the most common instruments in use. Overall, the use of SPC resources has been very small due to global financial difficulties the economy is facing, and some significant stimulus is needed to raise awareness among manufacturers of SPC initiatives to perform well in regional and international markets."

Boer Jozsef et al. [2] Researcher Present the strategy for the joint use of quality tools and human resources to accomplish good outcomes, in terms of higher manufacturing capacity, product volume and therefore quality, through direct executive staff motivated as an effect

of the use and use of quality tools. "Circles also allowed human capital to engage in the creation and execution of policies which are then applied as punitive mechanisms for a set of non-conformists producing losses at all rates. At the same time, the study of the implementation and usage of standard tools and human resources management was carried out Highlighting the positive effect these elements have on the efficiency of production."

B.P. Mahesh et al. [3] he concludes that "The best method to improve product or service quality is by improving the process used to make the product. Therefore, TQM emphasizes on method rather than performance, because the procedures determine the outcomes. There are many techniques available for improving the quality. Statistical Process Control (SPC) is one of several TQM methods generally recognized for identifying quality issues and optimizing production cycle efficiency".

N.A. Vitchuk et al. [4] he reserchon gas turbine engines be produced using quality control methods. The purpose of the research is to develop and substantiate suggestions for a manufacturing environment of pipeline manufacturing for gas turbine engines based on a single quality management methodology and the computation methodology of single and complex indices of industrial processes to achieve the purpose of the scientific regulations of general quality management. He analyzed that "To accomplish the aim of the Technical Regulations of Specific Quality Management, Evaluation Technique of Simple and Complex Indices of Industrial Process Efficiency, System Analysis and Control Methods, Systemic and Functional Modeling IDEF0, Efficiency Management Statistical Techniques, Reengineering Technique of an Operational Product Used".

Peter Butala et al. [5] Researcher approach the SPC solution is introduced by distributing SPC through the use of new information and communication technology, such as cloud services. An industrial case study demonstrates and explores this Predictive Operation Management as a Business Method. And he concludes that "The case study shows how a small business can use the SPC service to improve its process quality management and process control capability. Recent and historical knowledge about manufacturing practices is freely accessible from anywhere and at any time to the supplier and consumer. In its broadest context, data collection, obtained from eSPC, can also be used for output control and management. That kind of knowledge is of concern to plant workers, managers of production, service staff, preparation of output, administration of the upper level etc."

Masahiko Morilet et al. [6] Researcher Describe In the systems are implemented numerous management processes, data processing, remote control, continuing Kaizen approaches. Computer faults cannot however be removed absolutely, so diligent servicing and good

operation Networks are vital to corporate success. In the market, in particular, constructive servicing is positively embraced as a strategy for reducing computer failure and cost of repair. This paper introduces different sensing technologies to enhance the proactive maintenance functions. "Lean factory allows us to handle the quality of industrial machinery efficiently before shipping to the factory. Remote monitoring enables us to perform maintenance work efficiently on computers for customers after delivery. Sensing helps one to boost preventive functions Continuation."

PavolGejdosaetal.[7] He conclude that "SPC as well as the DMAIC method as instruments for continuous improvement of quality. Once, it was reported that with Stewart management tables, capacity indices, histograms can be used to handle variance management in the process to satisfy the customer's requirements. SPC as a very powerful mechanism for maintaining process reliability may be regrettable. Article advantages include the use of SPC with DMAIC interface for development. This mixture of tools is very suitable for achieving the desired quality improvement goals and can help in solving all the challenges and responsibilities of the quality improvement" Farzana Sultana et al. [8] He conclude that "SPC is a crucial TQM tool. Again, HDS is the real-time vision of every industrial industry's ground level. SPC is used as a quality assurance device in daily activity. Nevertheless, using HDS, SPC is used in this work to maximize overall performance, detecting significant failure times from different system breakdowns. Successful implementation of this paper's guidelines relentlessly increases the manufacturing performance of a production environment".

Gajendra Patidaretal.[9] He conclude that "In recent decades, SPC has been introduced to a vast number of companies around the world. Process management strategies and procedures in Manufacturing help businesses consistently meet and satisfy their customers' expectations in delivering low-cost, high-quality goods. Quality has become one of the customer's most important decision-makers in selecting competing products and services. Consequently, a crucial factor contributing to market performance, prosperity and an improved competitive place is recognizing and enhancing efficiency. Hence, an integral part of the overall business strategy should be the Quality Improvement programmed".

Pranay Suresh bhai Parmar et al.[10] He conclude that "Product quality is dependent on manufacturing process control capability. That's where SPC Statistical Process Control comes in. Statistical Process Control (SPC) uses statistical methods to monitor and control a full-potential operating process. Statistical process management is a set of techniques that can result in process consistency and elimination of variances when applied together. Control charts are used in SPC to calculate the variability in the method and the different methods used in the SPC such as simple 7QC software can continually increase it. 7QC Tools are called primitive since they are suitable for people with very little formal statistical training which can be used to solve the vast majority of quality-related issues. Management involvement and commitment of improving

quality are the key components of the potential success of SPC."

Soroush AvakhDarestaniet al. [11] He state that "Unequal factors for continuous flow industrial sectors can be monitored simultaneously, which helps to save product and process monitoring times. In reality, when statistically tracking the same characteristics of different sections, short-run charts is efficient, because inadequate data do not confirm the control charts' presumption of normality. Short run control charts can be useful in this context. Out-of-control signals were tested on short-run control charts in order to evaluate the SPC characteristics over time. This same data was shown to have no out-of-control point and no standard signals, and could be used as a standard for SPC implementation".

Soroush AvakhDarestanietal.[12] state that "unequal variables can be monitored simultaneously for batch production industries, which helps save monitoring time for products and processes. In practice, when the same characteristics of different parts are to be monitoring statistically, short-run charts are efficient, as insufficient data do not support normality assumption of the control charts. In this context, short-run control charts can be useful. To improve SPC characteristic over time, out of-control signals were test on short-run control charts. It was shown that the data had no out-of-control point and no no normal signals and could be used as a standard for implementing SPC".

OmogbaiOlegheetal.[13] He state that "Most scheduling studies concentrated on identifying an optimal schedule for a set of job shop orders, but little work was done to measure the performance of the optimal schedule. The scientific method outlined in this research paper provides an approach to measuring the performance of a schedule effectively and continuously. Statistical Process Control charts monitor differences within a process and are commonly used in control system performance. Through adding the Individuals Control Chart to the scheduling for a work store, we were able to use the chart's range limitations as output goals as the task deviations could be tracked and look for ways and remove or minimize the deviations. The approach would have more accurate timetables, which would improve operational preparation".

MetinUçurumetal.[14] He state that "The process variations have to be controlled using control diagrams and process capability index which is one of the important aspects in any production line. Controls diagrams R, and X are the most popular control charts. Statistical Process Control (SPC) methods can be simply applied on a foundry floor in order to control the process parameters and improve quality of the cast products".

Vikas Sheeletal.[15] he conclude, "SPC implementation is significant as can be seen from the results of the above case studies. From the above study of the different case studies, it can be concluded that to survive in today's era of competitive market, companies need to produce the quality products. In addition, quality can be achieved by using the SPC tools and techniques. The study reveals that SPC techniques can give the significant improvement to the quality. These tools and techniques are

simple to Implement and needs the top management involvement and employee support”.

S. Subbulakshmi et al. [16], “Better quality and production of product or process is a must for any Industry. Statistical Process Control (SPC) is an efficient controlling methodology for analyzing, monitoring, managing and recuperating process performance. Biggest benefits for implementing SPC in industries are enhanced quality products and condensed process variation. The objective of this paper is to examine SPC implementation in the industry setting by applying systematic literature review, and to explore the comprehensiveness of SPC applications in the industry”.

### III. PURPOSE OF STATISTICAL PROCESS CONTROL:

#### A. Data Collection

It all begins with collecting all the data we would need in your data analysis and gratitude to technological advances, we seem to have plenty of choices for that. Fitting our entire manufacturing plant with sensing devices that obtain all sorts of sensitive files is quite simple, but instead funnel this into a node that either gathers and collates the data or procedures it instantly.

#### B. Setting Appropriate Control Limits

One of most important concepts in SPC is control limits, so it is crucial that they will be placed at acceptable thresholds to eliminate incorrect outcomes. It'll also start taking some knowledge in your own particular field and the type of product that your company makes, and you may also need to have intricate knowledge of the machines that are used throughout the process. Occasionally the suppliers of different production equipment can supply you with readily accessible data for those limitations, but with our particular use case you will have to decide them yourself more frequently. The point of these limitations is that no manufacturing process is flawless, and the performance will still differ. However, in several cases these differences can be appropriate as they do not breakdown the end product quality. After you have set the correct limits, you will be able to more easily see essential outliers in our production systems.

#### C. Reevaluating Our SPC Implementation

You will have to make certain changes to the way we operate our SPC eventually, usually as the business expands and the needs move to a different path. It is required to carefully-evaluate the way users store and analyze our data on a regular basis, and we will do our best to even get input from your colleagues on that as well. People at some other parts of the company may be able to have certain details which are not so evident to you, and it can be especially useful and get as much input and feedback on ones SPC.

### IV. BENEFITS OF STATISTICAL PROCESS CONTROL

#### A. Decreased Scrap, Rework, As Well As Extended Warranties

Consistency is among SPC's main advantages. Soft drinks / cold drinks, for example. Everybody has to flavour the very

same, and although millions of bottles are produced daily. SPC ensures end product uniformity, whether one unit or a thousand units are produced daily. By ensuring consistency with tightly designed specifications, quality is assured and it can be reworked and RMA numbers have dropped.

#### B. Maximized Efficiency

Without SPC, the deformities / issues during the manufacturing process are hard to identify. Issues could only be recognized at the end of the manufacturing process, for example parts with defects. To find out the root causes of a fault creating the flaw, the manufacturing cycle must be halted or shut down entirely. This can take some time to find and fix the problem. Production problems are caught during the manufacturing process with SPC execution, but only a small portion of the production line has to be close down. The workflow of the specific problem area may be redirected to a manufacturing assembly line for backup. The entire assembly line is never entirely shut down, and so the continuous production is sustained. The same units are available every hour / day of operation while the manufacturing line 's issue area is under maintenance / repair. When patched, the assembly line for the backup output can be withdrawn from the network, and regular service resumes.

#### C. Increasing Operational Efficiency

SPC control charts show comparative statistics in a graph manner to measure the efficiency of the production. This identifies and shows some unexpected differences in procedures so that suppliers can check for various reasons / events. Statistical data allows real-time data to set production baselines, develop control over these baselines, enhance the production process, detect and fix defects or imperfections while relying on judgments or conclusions.

#### D. Manual Checks Limited

Identifying certain defects after the manufacturing cycle will result in loss from the product. After you have detected and corrected process errors, you can more quickly correct equipment configuration and start manufacturing products without requiring manual inspections. This is particularly true for the food & beverage / FMCG industry which operates in a "tightly woven supply chain" and "must show that their products meet prescribed quality standards. When this sector advances from compliance to SPC, the data required to increase overall manufacturing / operational performance will be obtained and analysed.

#### E. Improved Customer Satisfaction

An aim of each company is to fulfil (or) surpass the requirements of the customer and to become a reliable supplier (or) long-term business partner to a customer thus meeting the needs of the customer. A vehicle maker, for example, needs to rely on its provider of parts for high quality spare parts at a cost-effective price. When a supplier often delivers parts that are of poor quality, the manufacturer can take his business somewhere. The retailer is guaranteed customer satisfaction when using SPC, as the distributor may count on a product of high quality.

#### F. Costs Reduced

SPC is very effective in reducing / attempting to control production (or) costs. Through holding a focus on customer satisfaction, flaws are found before shipping (or) arrival of consignments of the goods. Car recalls are a prime example of ineffective SPC. It costs hundreds of millions of pounds to a car manufacturer to redesign on cars to fix that problem. The question can be found out before the finished product exits the processing plant if SPC is used effectively. Scrap and rework costs can be minimized by successful application of SPC, as mentioned above.

#### G. Extensive Analytics and Reporting

SPC offers instant reviews of each application layer on their SPC results. All the files can be previewed, scanned, stored in PDF format or submitted directly to the system via email. Generic reports are tailored by the managers and engineers depending on their particular specifications and may involve several diagrams on one page.

#### V. CONCLUSION

- 1) If correctly used, SPC helps producers to eliminate complications, monitor their manufacturing processes and eventually maximize profitability and customer loyalty.
- 2) Production management of the operational method guarantees real time monitoring of the entire business, resulting in cost-effective production and optimal utilization of all capital. Manufacturing organizations are going to use SPC to evaluate its effect, find issues and track the outcomes you can change to achieve your quality objectives

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