Chapter 17
Fundamental Ideas Behind Control Charts

Boya Venkatesu
Woxsen University, India

ABSTRACT

This chapter explores control charts. When the control chart shows that the process being monitored is not in control, the analysis gained from the chart can be useful in pinpointing the causes of the variation because it could lead in the process functioning lesser effectively. A stable process that runs beyond the intended bounds of specifications must be improved by a conscious move aimed at grasping the root causes of the current performance and fundamentally enhancing it. It explores different context of control charts, and it can be helpful find the fluctuations in real time business applications.

INTRODUCTION

The term "Quality" was used in the pre-world-war days, to mean *fitness for use*. The modern quality gurus however viewed quality as "the potential loss to the consumer created due to a nonconforming product/service". Juran et al. (1998) gave a managerial outlook to 'quality' which is different from the engineering outlook perceived by manufacturers.

The word "quality control" refers to all an organization's activities that are accountable for fulfilling product and service quality standards. It is a task that includes of groups of professionals who have certain tasks to maintain quality.

Statistical Quality Control (SQC) is explaining the application of different statistical tools to analyze quality-oriented data in industries.

According to Ishikawa (1978)

to practice quality control is to develop, design, produce and service a quality product which is most economical, most useful and always satisfactory to the consumer. To meet this goal, everyone in the company must participate in and promote quality control, including top executives, all divisions, within the company and all employees.

DOI: 10.4018/978-1-6684-6519-6.ch017

The early development of statistical methods for quality control can be attributed to the notion of control charts proposed by W.A. Shewart (1924) and therefore the idea of *acceptance sampling plans* by Dodge and Romig (1920).

SQC is divided into two broad categories: a) process control and b) product control. The concept "process control" refers to the use of statistical approaches in the design and monitoring of a process, irrespective of the quality of incoming materials or product marketing strategies. The word "product control" refers to sampling plans that help accept or reject lots of incoming goods based on limited (sample) inspection. Both the process and product control methods rely on statistical inference. In simple terms we estimate the process behavior in terms of the fraction defective or the mean of a measurement or Variation in the process. We also test one or more hypotheses about the process parameters by periodically monitoring the process.

No process can be perfect in relation to standards. Variation occurs when many items are manufactured on a machine or system even though it is designed with high technical strength. There are two broad causes of Variation as follows:

1. **Random causes**: These are causes which are challenging to identify and to eliminate. It is like one's signature showing Variation when repeated 10 times even though the person, pen, paper, and environment is maintained stable. It is called natural Variation and it is usually uneconomical to search for random causes. As such they are left unchecked.
2. **Assignable causes:** The Variation possibly created due to change in operator, machine, material grade etc. can be identified and corrected. These are called *assignable causes.*

It is assumed that the total observed Variation is the some of these two components, expressed as

$$\sigma^2_{Total} = \sigma^2_{Ass} + \sigma^2_{Ran}$$

where

σ^2_{Total} = Total variation

σ^2_{Ass} = Variation due to Assignable causes

σ^2_{Ran} = Variation due to Random causes

(Variances can be added but not standard deviations)

In this additive model, it is possible to check the presence of assignable causes because any abnormal variation must be due to them. According to theory of normal distribution, the tolerance under random causes can always be estimated and any variation more than this tolerance indicates the occurrence of assignable causes.

In the following section a brief review about the statistical methods used SPC (Statistical Process Control) is provided.