Control Charts

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Section 2

As worldwide businesses have become more quality conscious nowadays in the wake of increasing competition with one another, firms have applied statistical methods to improve quality and maintain control over manufacturing processes. A control chart is a popular, practical, and statistical tool in monitoring production processes in order to determine and control product quality. A control chart is used to study variation of a repetitive process.

Every process in one way from another varies. To illustrate this reality, write your name ten different times. If you compared your handwriting collectively no two signatures will be exactly alike. The random variation would normally be common and expected, however there is also a type of variation called special cause variation that is totally unexpected within the process. This can be shown for example by when somebody bumps into your elbow while you write your name on one of the ten trials. This also may alter the way your signature looks significantly. Special causes are crucial to catch since if hypothetically this were a process repeated ten different times in diamond cutting. The seemingly harmless bump to the elbow can be substituted for some other variation factor related to diamond cutting for example, in which case it would become quite an expensive special variation.

Thankfully there is an easy way to determine the two different types of variation. This is found in control charts or sometimes referred to as Shewhart charts. The history of control charts goes back to a Dr. Walter Shewhart, an employee of Bell Labs, who developed control charts in 1924 for manufacturing purposes. W. Edward Deming

extended this concept and further developed Shewhart's ideas to all areas of improvement in an organization creating the discipline of total quality management.

Variable and attribute charts are the two different types of control charts. Variable charts assess quantitative features like height, weight, volume, and etc. An airplane's speed is an example of this measure of data. Attribute charts, however, are usually denoted by a letter such as p charts, c charts, u charts, and etc. P charts show the percentage of defectives in a set. C charts show the number of defectives per unit in a set. U charts show the average number of defects in a set. Attribute charts make up only a part of the whole from the all-encompassing influence of control charts. Attribute charts have become the dominant trait when one thinks about control charts in general. The many different varieties of control charts can be applied to different kinds of data that need to be processed.

Every control chart has three fundamental elements that can be identified. A centerline or the mathematical mean of all the samples plotted, upper and lower control limits that show and set limits on variations, and the data plotted over time. The closer variations fall to the mathematical mean the more control the process is in. It would be in the best interests of any organization to achieve the closest proximity to the average. A chart with an upper control and lower control limit is statistically determined. Any value above or below these limits is "out of control" also referred as the special variation. Too many of these values usually indicate something has gone wrong. Most of the values should fall between the upper and lower control limits to exemplify for the most part that the process is in control and any variation is not an outlier, but just common variation.

Having the data points plotted over time can be done many different ways depending upon the attribute chart, but most are done on some sort of graphical interface.

Following this information, there are some characteristics to lookout for in how to use and fully utilize the powerful tool of control charts. The point of making control charts to begin with is to look at variation, seeking special causes and keeping track of random causes. Special causes can be recognized and discovered by some simple tests. First of all, if one data point (outlier) falls outside of the control limits set then that is most likely a special cause. Another important observation is if six or more points are in a steady row of increasing or decreasing in the chart. Also, if eight or more points lie in a row on either side of the mathematical mean or centerline then that could be due to special variation. Lastly, but most obscurely if fourteen points alternate up and down then that may be something to responsible for in special cause. A good idea when implementing control charts is to pair two control charts together and compare inconsistencies to help further maximize control chart effectiveness.

To fully understand the concept of control charts consider the real world instance with soap bar production. A production manager wants to monitor the mean weight of soap bars produced on the line. The target value of the weight of a single soap bar is 50 grams. Also given is the estimate of the weight standard deviation for a single soap bar, is 10 grams. Daily samples of 5 bars are taken, during a stable period of the process. For each sample, the weights are recorded, and their mean/average is computed. The sample means are estimates of the process mean.

A control chart is a tremendous graphical and analytical tool used by quality technicians to control, analyze and document the processes involved in production and other quality-relevant areas. As quoted by Deming, “There is no such thing as constancy in real life. There is, however, such a thing as a constant-cause system. The control chart will tell you whether your process is in statistical control”. In a business, control charts contribute to process analysis that can improve productivity, quality, and efficiency by establishing what needs to be altered within an operation. If control charts are implemented correctly, they can become a commanding advantage in the greater philosophy of total quality management in an organization.

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