What Is A Shewhart Chart?

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Shewhart charts are used to display data in the form of a graph and present the variations that may be present in the data. It is similar to a run chart and uses the x and y-axis to present data variables in chronological order. It can be divided into subgroups, making it easier to observe the variations in data over time. In the chart, a line presents the data points, and a centerline (CL) is used to present the mean of these data points. The Shewhart chart allows a control limit, which makes it a better choice than the run chart (Schmid, 1995).

Shewhart Chart Vs. Run Chart

To understand the reason behind the Shewhart chart being a better choice as compared to the run chart, the run chart needs to be explained as well. A run chart is a very simple representation of data in the form of a graph; simply, it can be constructed with only a pen and paper. This makes it a good choice to observe a small chunk of data. In this case, the question arises of whether the run chart is easier and similar in construction as compared to the Shewhart chart; then, what is the reason for using the Shewhart chart over the run chart? Three reasons make the Shewhart chart better than a run chart, which are explained below.

1. Shewhart charts are more sensitive as they can identify unusual causes, which may be a consequence of point-to-point data disparity, which is made possible due to the CL that allows the mean calculation of the data. The run chart, on the other hand, does not have a CL, so it can only present the data as above or below the median. The absence of CL in a run chart makes it difficult to detect the variations in the data. So if a singular data point is seven above the median and another is twenty-eight above the average, then both will be treated the same. This is because, in a median, both data points are present on the same side. However, if these data points are observed using the Shewhart chart, then due to the presence of the CL, the variations between these data points become obvious. The mean of the CL allows for the absolute value to be obtained.
2. The added features of the Shewhart charts allow for the control limits and zones to be added to the data. These features do not exist in the run chart. In the Shewhart chart, the upper control limit is referred to as UCL and the lower control limit is called LCL. Collectively, UCL and LCL are known as sigma limits. The sigma limits define the boundaries of the variation.
3. It is easier to predict process behaviour, performance, and capabilities much more accurately with a Shewhart chart than it is with a run chart, which can only make predictions when random

variations are present (Perla et al., 2011).

3 Questions While Using The Chart

When there is a need to use the Shewhart chart, it is imperative to make sure that three questions are answered beforehand, as these will help in processing the data accordingly.

- The first question is, “How many data points are needed for the Shewhart chart?” Whenever the chart is being developed, it is of utmost importance to plot the data points on the chart, which will give a simple line on the graph. If the data points are less than six, then the trend rule can be determined using the run chart only, but if it exceeds it, then the Shewhart chart is needed as variables in data points have increased. In simple words, when the data has increased, then the Shewhart chart should be used (Teoh, 2013).
- The second question is, “What is Sigma, and why are three of them needed?” This is a complicated question as it poses technical challenges. Whenever there is an array of data, then three factors of data distributions need to be considered as these will allow for sigma limits to be identified. These distributions are the central tendency, dispersion or spread and the shape of the distribution. These are statistical values calculated, which allow for the sigma values to be identified.
- The third and last question that you need an answer to is, “Do I apply the run chart rules to Shewhart charts?” There is a very easy response to this, which is “no”. The rules of the run chart should only be used in the run chart. The Shewhart chart has its personal rules that allow the data collector to identify violations in the data or any errors that cannot be found easily. These rules provide guidelines that make it easy to identify any discrepancies that might be present in the data. If you have answers to all these questions, then a successful Shewhart chart can be constructed.

5 Rules Of Shewhart Chart

The Shewhart chart has five rules that help detect special causes in the data; however, it is necessary to identify which of these rules can be applied to healthcare systems so that these rules are explained in detail.

- “Rule 1: 1 point outside the +/- 3 sigma limits” usually signifies that there is a sigma violation present in data that causes the data to become unstable. It is easy to identify this error as it is based on the data points and can be resolved using statistical calculations.
- “Rule 2: 8 successive consecutive points above (or below) the centerline” is a difficult error to detect as it indicates violation even when the data points are in the correct position in the CL. This is referred to as “eight consecutive data points on the same side of the CL”, so when you observe this phenomenon, then there is a shift in the process.

- “Rule 3: Six or more consecutive points steadily increasing or decreasing”. This rule helps detect the trend of a small and consistent shift in the process of data.
- “Rule 4: Two out of three successive points in zone A or beyond” helps detect instability in data when two out of three data points are more than two sigmas away from the centerline. This indicates that a single data point is not in Zone A and is anywhere else on the chart. To correct this, two out of three data points should be brought back in “Zone A or beyond on the same side of the centerline”.
- “Rule 5: Consecutive Points in Zone C on either side of the centerline”, in this test use of stratification is employed, which allows identifying two or more different causal systems are present in every subgroup (STUART HUNTER, 1989).

Conclusion

The Shewhart chart is a very useful way to observe data and different variables that may present themselves over time. The construction of this chart allows for a more detailed assessment of data as variation can be observed between each data point. The errors and unstable data can be eliminated using the five rules discussed above. Additionally, different types of charts within the Shewhart chart allow for more relevant data collection and processing. These characteristics make it a very effective tool in data study compared to the run chart, which is a very simple graphical representation of data. The Shewhart chart should be used when there is a significant amount of data so that proper results can be acquired.

References

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