SEVEN BASIC QUALITY TOOLS

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7QC in Project Quality Management

The Seven Basic Tools of Quality is a designation given to a fixed set of graphical techniques identified as being most helpful in troubleshooting issues related to quality. They are called basic because they are suitable for people with little formal training in statistics and because they can be used to solve the vast majority of quality-related issues. The seven tools are: Cause-and-effect diagram (also known as the "fishbone" or Ishikawa diagram), Check sheet, Control chart, Histogram, Pareto chart, Scatter diagram, Stratification (alternately, flow chart or run chart). The designation arose in postwar Japan, inspired by the seven famous weapons of Benkei (Ishikawa, 1985). It was possibly introduced by Kaoru Ishikawa who in turn was influenced by a series of lectures W. Edwards Deming had given to Japanese engineers and scientists in 1950 (Ishikawa, 1985).

At that time, companies that had set about training their workforces in statistical quality control found that the complexity of the subject intimidated the vast majority of their workers and scaled back training to focus primarily on simpler methods which suffice for most quality-related issues. The Seven Basic Tools stand in contrast to more advanced statistical methods such as survey sampling, acceptance sampling, statistical hypothesis testing, design of experiments, multivariate analysis, and various methods developed in the field of operations research. The Project Management Institute references the Seven Basic Tools in A Guide to the Project Management Body of Knowledge as an example of a set of general tools useful for planning or controlling project quality (PMI, 2013).

Cause and Effect Diagrams

These diagrams are tools that organize a group or persons knowledge about the causes of a problem or issue and display the information graphically. It was originally created and used by

Dr. Kaoru Ishikawa and is sometimes called an Ishikawa Diagram (Magar & Shine, 2014). Also, because of its shape it is called a Fishbone Diagram. In general what you do is brainstorm ideas (causes) then group them in to categories. Those categories become the many branches of the Cause and Effect diagram.

Check Sheets

This is another simple but powerful tool. Check Sheets are lists of items and the frequency that the item occurs. They can be made in so many different ways that many times, we don't think of them as a list, but they are. They are used to answer many important questions such as: Has all the work been done? Has all the inspection been done? How frequently a problem occurs? (Magar & Shine, 2014). They are often used to remind individuals doing complex tasks of what to do and in what order. They are also used many times in conjunction with other tools to help quantify or validate information.

Control Charts

Control charts are the most difficult of the seven tools to use. They are seldom the method of choice (Magar & Shine, 2014). When a process step is important, we would prefer that the step not vary at all. Only when this cannot be accomplished in an economical way does one choose to use a control chart. Control charts are only useful if the step (operation or function), over time, exhibits measurable random variation.

Control charts display the data over time (Time is on the x axis above listed as sample). Control Limits (the red lines) are displayed on control charts, where data falling within the control limits are considered "normal" variation (Magar & Shine, 2014). Any point outside the control limits are considered "special caused" variation and need to be look at and corrected through an action plan. If you create a control chart, you must also have with it an action plan.

Besides control limits for control charts, there are several other type of trends (runs) that can indicate an out-of-control process.

Histograms

Histograms are a “picture” of a set of data (or information). It is created by grouping the data you collect in to “Cells” or “Bins” Histograms take your data and give it a shape (Distribution) (Magar & Shine, 2014). With this, you can see the data sets spread, central tendencies, and if it meets requirements. It is a valuable troubleshooting tool. You can take it a compare differences between machines, people, suppliers etc. Never use a histogram alone always also plot it in a time ordered plot (run chart).

Pareto Charts

Pareto Charts are a specialized Histogram of count data. It arranges the Bins or Cells in largest to smallest counts and gives you an accumulation line as seen below. The Pareto Chart gets its name from the use of the Pareto Principle which states “80% of the effect comes from 20% of the causes” (Magar & Shine, 2014). Vilfredo Pareto, an Italian economist, originated this principle by determining that 80% of the land in Italy’s owned by 20% of the population (Magar & Shine, 2014). Later it was found to hold true in many things and help us focus on the critical few. With a chart like this a team can decide where to place its priority and focus (the big hitters). This is extremely helpful when time and money is limited as it is in most cases.

Scatter Diagrams

Scatter plot are a very simple tool to use to see if there is a correlation between two things (i.e. does one thing lead to another). I always before going into any major analysis of data, plot the data in some way to get a “gut feel” of what is happening. This tool lets you create a simple picture showing how two or more variables change “together”. The scatter diagram graphs pairs

of numerical data, with one variable on each axis, to look for a relationship between them (Magar & Shine, 2014). If the variables are correlated, the points will fall along a line or curve. The better the correlation, the tighter the points will hug the line.

Stratification

To me Stratification is a catch-all for summarizing, picturing, or applying some tool to data so you can understand what is happening. Stratification is the process of dividing members of a population into homogeneous subgroups before using it. The data (strata) should be mutually exclusive: every element in the population must be assigned to only one subgroup (stratum) (Magar & Shine, 2014). The data should also be collectively exhaustive: no population element (data) can be excluded. In many texts they list either flow charts or run charts under this seventh tool area. A run chart is just the "Individuals Chart" of the above control chart without control limits. A flow chart takes a group of steps in a process and summaries them into a map of the way the process works. They are sometimes called a Process Map or a Process Flow Map.

Summary

Statististical QC is chiefly concerned in making sure that several procedures and working arrangements are in place to provide for effective and efficient statistical processes, to minimize the risk of errors or weaknesses in procedures or systems or in source material The seven QC tools are most helpful in troubleshooting issues related to quality. All processes are affected by multiple factors and therefore statistical QC tools can be applied to any process (Magar & Shine, 2014). The continuous use of these tools upgrades the personnel characteristics of the people involved. Overall, it enhances their ability to think generate ideas, solve problem and do proper planning.

References

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