WBS 5.6, Explanation of Seven Quality Control Tool

by

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Abstract

The Seven Quality Control tools known as 7QC are used to analyze data from processes and to obtain useful information. The information can be used to monitor, control, predict or evaluate outcomes, processes, or performance. They also aid in identifying root causes. Project Managers use these tools to communicate with stake holders about outcomes, processes and performance. 7QC tools can also be used for process improvement, implementation and Tracking. This paper identifies each tool and some of what they may be used for within a project management environment.

The seven quality control tools known as (7QC) are analytical tools used to identify process problems. They are most often used in projects and manufacturing but can be adapted to anything with enough data to analyze. These are often referred to as problem solving tools however resolving problems identified by these tools usually takes further action. They also act as monitoring tools to evaluate progress and aid in forecasting change requirement. As the name implies there are seven different tools that can be use singularly or in concert; these are Cause and effect diagrams, check sheets, control charts, Histograms, Pareto Charts, Scatter diagrams and Stratification (Flow Charts & graphs)

Cause-and-effect diagram (Ishikawa or fishbone chart)

Description. Cause and effect diagrams help to organize the knowledge of possible causes for an effect and display them graphically. A group or individual attempts to identify all of the possible causes and categorizes them into a graphical diagram with different legs. The diagram often uses a single line directed at the effect or problem, with several branches tied to it for the categories and offshoot branches to identify the causes. "The detailed sub-categories can be generated from either or both of two sources: Brainstorming by group/team members based on prior experiences, Data collected from check sheets or other sources." (Fishbone Diagram). The appearance (Figure 1) of a fish bone like structure is what gave the process its nickname. These graphical depictions can be used to "identify the underlying symptoms of a problem or "effect" as a means of finding the root cause" (7 Basic Tools of Quality). Start by determining the main categories of the cause i.e. people, equipment, processes, management; or as in the example, process, assembly, design, and Fabrication etc. These form the major branches connected to the spine of the diagram.

Figure1 Example of a Cause and effect Diagram

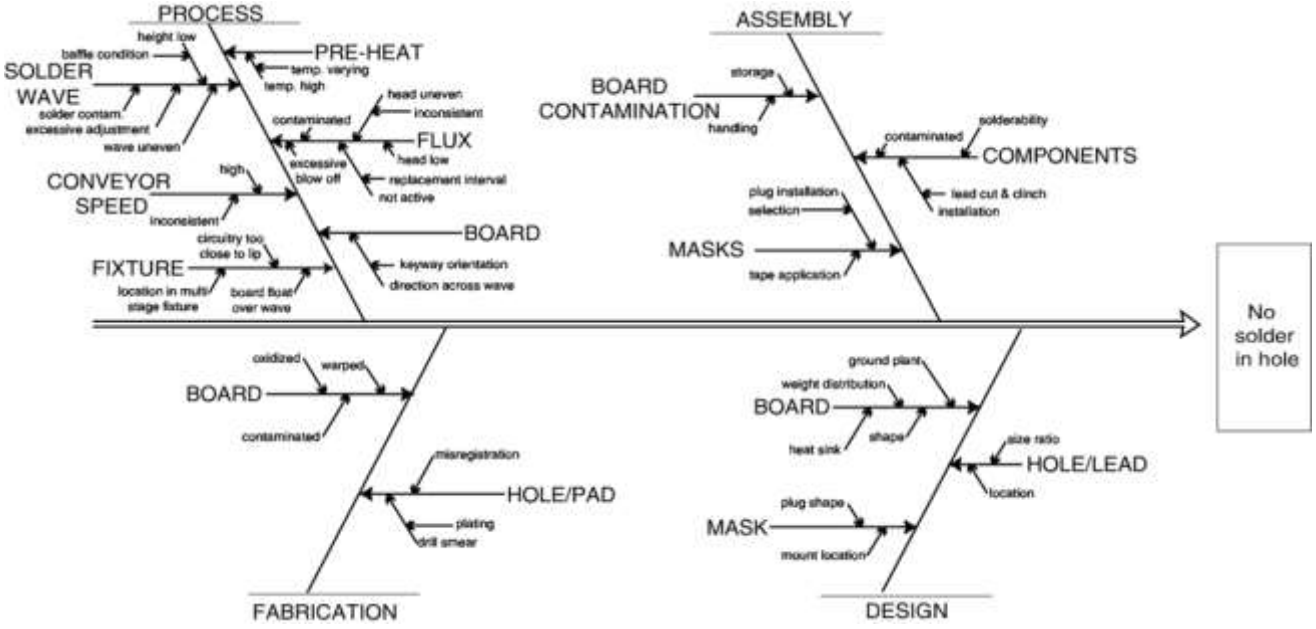


Figure used to depict the fishbone diagram from (Bersbach, 2011, para 1)

Application. Used primarily as a process improvement technique the cause and effect tool can also help identify the relationship between causes to help prioritize possible responses. "The usefulness of a Fishbone Diagram is dependent upon the level of development - moving past symptoms to the true root cause, and quantifying the relationship between the Primary Root Causes and the Effect. You can take the analysis to a deeper level by using Regression Analysis to quantify correlation, and Designed Experiments to quantify causation" (Fishbone Diagram).

Check sheet

Description. Check sheets are a form created to collect data. The complexity of each sheet depends on the type of information desired to collect. It can be as simple as identifying the when cars passing an intersection have the windows down, up or partially down, to the rate of and point of Check Sum Errors in a particular program debugging operations.

To create a Check Sheet: first decide what you want to observe. Use this to identify the title for the Check sheet; this helps define the operation as you go forward. Next, decide the

length or number of periods you wish to observe; this should cover a broad enough spectrum view the whole operation cycle and enhance accuracy of the data. Then design a form that is easily understandable and the data can be indicated by using simple markings such as a check, slash or "X." Label the form to indicate the event along one edge and observation breakdown (may be time period) on the other. It is best to include an area to total the number of indicated marks in reference to an observation. "Data collected using check sheets needs to be meaningfully classified" (Magar & Shinde, 2014, p 370). Without meaningful classification the date is vague and unproductive for analysis.

Figure 2 Example of Check Sheet

Telephone Interruptions

Reason	Day					
	Mon	Tues	Wed	Thurs	Fri	Total
Wrong number	𝍸	II	I	𝍸	𝍸 II	20
Info request	II	II	II	II	II	10
Boss	𝍸	II	𝍸 II	I	IIII	19
Total	12	6	10	8	13	49

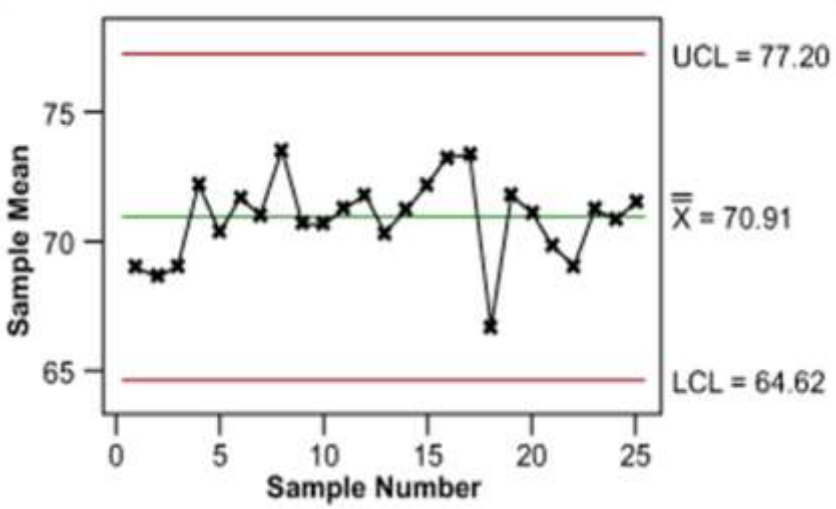
Excerpted from Nancy R. Tague's The Quality Toolbox, Second Edition, ASQ Quality Press, 2005, pages 141–142 (as cited in Check Sheet)

Application. Check Sheets are used to collect data which may be used with other quality tools. Consider using a check sheet: "when data can be observed and collected repeatedly by the same person or at the same location; when collecting data on the frequency or patterns of events, problems, defects, defect location, defect causes, etc.; when collecting data from a production process" (Check Sheet). Some uses maybe: attendance records, production interruption logs, equipment break down logs, error log etc.

Control Charts

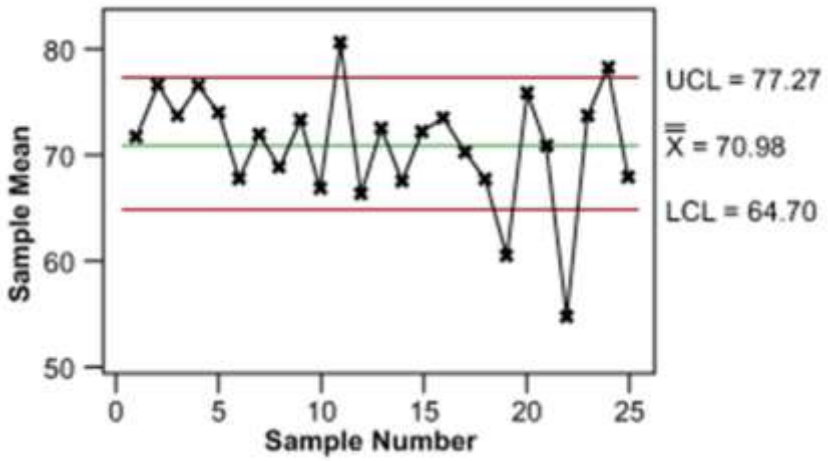
Description. The idea of the control chart was envisioned by Dr. Walter A. Shewhart in the 1920"s (Magar & Shinde, 2014, p 368). It helps to identify preventable problems by observing whether the causes are random or related quantifiably. Control charts have similar characteristics to a scatter diagram but, as identified by Carl Berardinelli they have three main distinguishable elements: "a time series graph, center line [or mean line], and upper and lower control limits" (n.d.). Using this tool you can identify controlled and uncontrolled variations in outcomes. Controlled variations or variations that fall within the upper and lower limits on the chart are predictable and therefore actionable. Those more random variations falling outside the control limits indicate unpredictability and are considered uncontrolled; any actions taken will have a unpredictable outcome. Greater numbers data points falling outside the control limits indicate greater unpredictability in the process is.

Figure 3 Example of Controlled Variation



Sample copied from Carl Berardinelli's Figures 4 demonstrating controlled variation.

Figure 4 Example of Uncontrolled Variation



Sample copied from Carl Berardinelli's Figures 5, demonstrating uncontrolled variation

Application. "Control charts have two general uses in an improvement [process]. The most common application is as a tool to monitor process stability and control. A less common, although some might argue more powerful, use of control charts is as an analysis tool" (Berardinelli). As a control tool the control chart can indicate whether or not a process is in control or requires further investigation. Other tools need to be employed to find out what processes need remediation.

Histogram

Description. A histogram is a bar chart which helps identify a frequency distribution patterns. A frequency is the "number of times a given quantity or group of quantities occurs in a set of data" (Frequency distribution). "[These] patterns of observations [are] grouped in convenient class intervals and arranged in order of magnitude" (Magar & Shinde, 2014, p 366). (See Figure 5)

Figure 5 Example of a Histogram

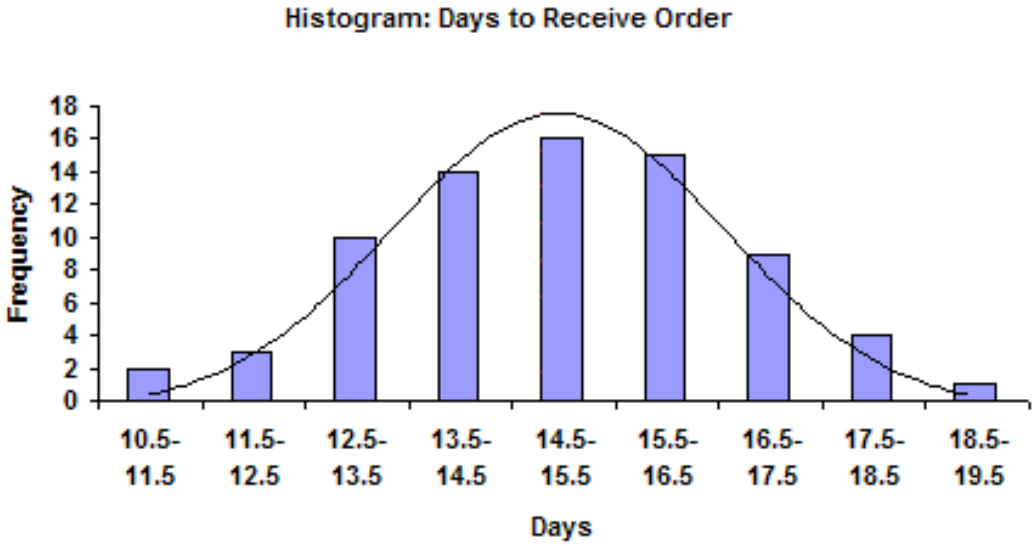


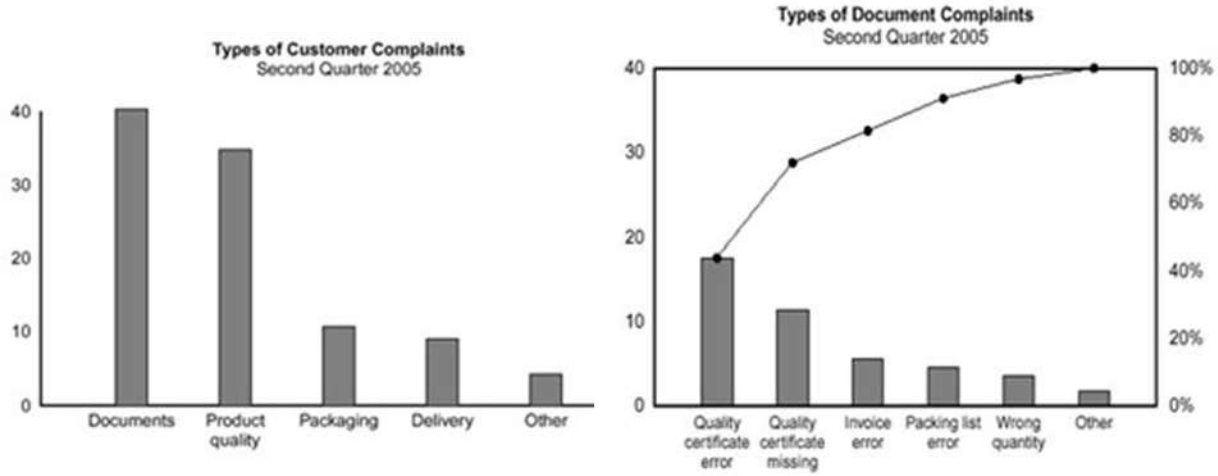
Figure 5 is an example of a histogram copied from NcNeese, B. (2005, December). Histograms - Part 1 | BPI Consulting. Retrieved November 20, 2016, from https://www.spcforexcel.com/knowledge/bar-charts/histograms-part-1

Application. Histograms are used when you want to express distribution of data quickly and in an easy to understand fashion. They help to highlight data that may or may not fall within a normal distribution. They can help identify the impact of changes that have occurred in a process. They can also show the percentage of the processes which meet the customers' expectations.

Pareto chart

Description. **"**A Pareto chart is a bar graph. The lengths of the bars represent frequency or cost (time or money), and are arranged with longest bars on the left and the shortest to the right. In this way the chart visually depicts which situations are more significant" (Pareto Chart). Pareto chart relationships can indicate the next step for analytical breakdown require another chart.

Figure 6 Pareto Chart Example



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In this diagram the first chart indicates that Documents received the highest number of complaints. Creating the second chart helps isolate what type of document was the problem; allowing the company to dedicate resources. Excerpted from Nancy R. Tague's The Quality Toolbox, Second Edition, ASQ Quality Press, 2005, pages 376-378. (as cited in Pareto Chart)

Application. This tool is used for prioritizing project improvements, identifying the frequency of customer complaints or highest number for negative responses. "Dr. Juran suggested the use of this principle to quality control for separating the "vital few" problems from the "trivial many" now called the "useful many" (Magar & Shinde, 2014, p 365). Vilfredo Pareto observed that a large portion of the wealth was controlled by a few people and that this patter was common in many fields. Finding the one problem area that make up for a majority complaints assists in prioritizing where assets should be used to achieve maximum results for the least effort or cost. .

Scatter diagram

Description. Scatter diagrams are particularly useful in investigating the relationship between variables (Render, Stair & Hanna, 2012, p116). Using two variables you plot a series of points with the independent variable listed on the horizontal axes and the dependent variable on the vertical access. As the plotted points begin to propagate the chart a pattern may emerge. The more closely related the variable are the more defined the pattern will be. Total random plot

points with no visible pattern indicate the variables have little to no relationship. If the variables are related the patterns can indicate the type of relativity ; they can be strongly relative, a tight grouping of dots, weakly relative, points are more spread out, a positive relationship, up and to the right, negative relationship, down and to the left, cyclical or curvilinear relationship, a wavy or curving pattern, or a combination. Regardless when a relationship established useful information is available for evaluation.

Figure 7 Scatter Diagrams (relationship = correlation)

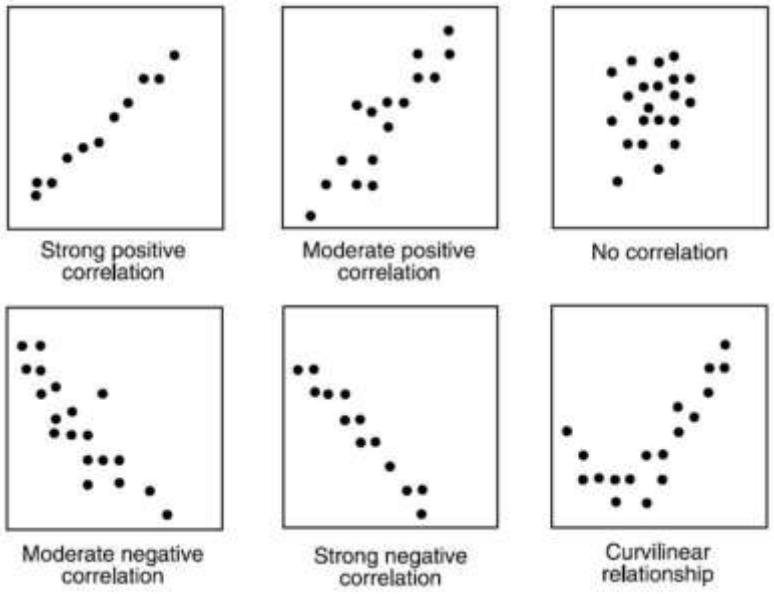

Figure 7 is an Image demonstrating Examples of Weather Scatter Charts from 5 Best Images of Temperature Scatter Diagram Examples. (n.d.). Retrieved November 20, 2016, from http://www.gridgit.com/post_temperature-scatter-diagram-examples_302574/

Application. The Scatter diagram helps to establish relationships between processes. In a quality control process wrongly assuming a relationship between two activities an lead to wasted time and money pursuing the wrong fix action. Scatter Diagrams can also be used to identify trends for forecasting sales, future cost, or when to buy inventory.

Stratification (Flow Charts & graphs)

Description. I found a disparity between Stratifications, Flow Charting and Graphs. Depending on which site your visit Stratification is sometimes listed similar to scatter plot diagrams with several different processes overlaid. And having a key indicating how each process is marked to identify it on the chart.

Others refer to the stratification process similar to Flow charting where processes are placed in a logical order of performance. Typically using word boxes, circles, triangles or other shapes for each process depicting from initiation to process completion and may have a return leg for a reworking a process.

Graphs are simply visual representations of data. Many of the processes we have already discussed use graphs to allow the person to quickly identify patterns.

Application. The uses for these tools are to present information in a logical easy to understand and evaluate format. Flow Charting helps to visualize step by processes and can allow quick deduction of where a step may be missing or where a process is failing. By using other quality control tools with a flow chart a plan can be developed to address a problem at the process action point. Graphs help to communicate analytical data without having to peruse through all the numbers. Often you can reach conclusions simply by view a well-made chart verses performing the formulas or algorithms to obtain exact information.

Conclusion

7QC tools are extremely useful in acquiring logical data and displaying it. Many of the tools can help track, forecast and evaluate processes, potential for problems or explain how and where a problem lies. Although many have similar uses the each present the data in a manner

uniquely for specific purposes. Often more than one tool is used to obtain useful information. Yet at time the mere display of the analysis in a chart can answer a thousand questions.

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