Seven Quality Concepts

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History

In 1950, W. Edwards Deming traveled to Tokyo, Japan to deliver a series of lectures to the Japanese Union of Scientists and Engineers (JUSE). Among these was an associate professor, at the University of Tokyo, by the name of Kaoru Ishikawa. Ishikawa took the information and concepts presented by Deming and formalized the Seven Basic Tools of Quality Control ("Manufacturer's Edge," 2017). The Seven Tools in Ishikawa's toolbox were:

- Cause and Effect Diagrams
- Check sheet
- Control (Run) Charts
- Histograms
- Pareto Charts
- Scatter Plots
- Flow Charts

Today, the Seven Basic Quality Tools are known as the Seven Quality Concepts (7QC) and are those tools used within the context of the Plan-Do-Check-Act (PDCA) Cycle to solve quality-related problems (*PMI*, 2013, p. 236).

Cause and Effect Diagrams

Cause and effect diagrams are graphical representations used to identify a problem or issue and associate the possible causes for that situation. Created by Dr. Ishikawa, the Fishbone Diagram, named because of its shape and resemblance to a fish, provides a means of graphically representing a problem and its possible causes ("Bersbach Consulting," 2011). During a brainstorming session, this tool provides the type of cause and effect representation that is easy to understand by all team members, regardless of experience. *Figure 1,* represents a generic Fishbone template.

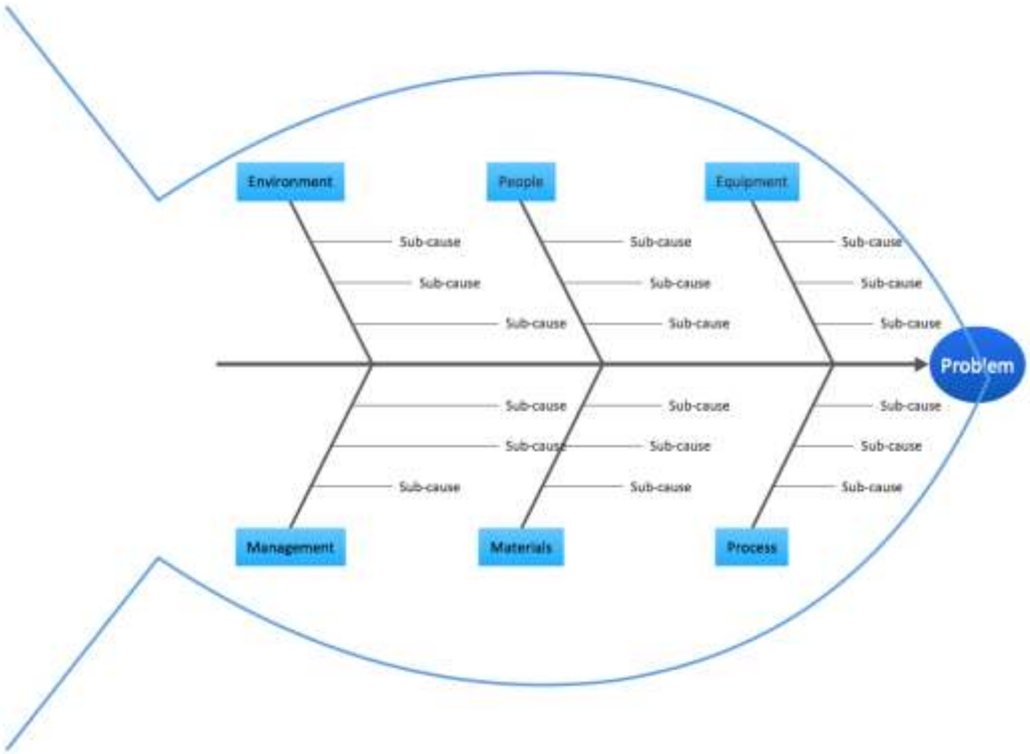

Figure 1. Generic Fishbone Template

The use of Fishbone Diagrams in monitoring and control

Monitoring and controlling projects require an understanding of causes for effects. During the brainstorming session, possible causes and effects are noted for understanding and reference. As the project unfolds, monitoring will be able to discover issues and immediately move to identify the cause and cure. By understanding this relationship, project management can effectively control effects.

Check Sheet

Known as Data Collection sheets and Tally charts, check sheets allow for the collection of real-time data. The more data collected, the more graphical the presentation becomes. Because the data is collected and analyzed in real-time, decisions made will be based on facts and not hypothetical information ("Manufacturer's Edge," 2017). The ability to customize check sheets makes it possible to track any data point in real time. *Figure 2*, represents a generic check sheet.

Name of Data Recorder: Lester B. Rapp
Location: Rochester, New York
Data Collection Dates: 1/17 - 1/23

Defect Types/ Event Occurrence	Dates							TOTAL
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	
Supplied parts rusted		9	5	4	2			20
Misaligned weld			3			2		5
Improper test procedure								0
Wrong part issued		1		2				3
Film on parts								0
Voids in casting				4	2			6
Incorrect dimensions						2		2
Adhesive failure								0
Masking insufficient					1			1
Spray failure			5					5
TOTAL	0	10	13	10	5	4	0	42

Figure 2. Sample Check Sheet

Check sheets provide a means to monitor and control quality covering a myriad of quality points. A collection of real-time data makes it possible to identify trends and prioritize them for correction. Example: The above chart indicates the largest issue relates to supplied parts rusted. It also indicates the number of rusted parts diminishing throughout the week. The early detection on Monday may have played an integral part in correcting the issue in real-time.

Control Charts

Control charts are graphs used to study how a process changes over time ("American Society for Quality (ASQ)," 2017). The chart helps ensure statistical control by representing data in real time, plotted against the expected performance and the upper and lower tolerance limits. *Figure 3* represents a sample control chart with upper and lower tolerances given. The upper and lower limits provide a means of identifying when a variation has exceeded the allowable tolerance.

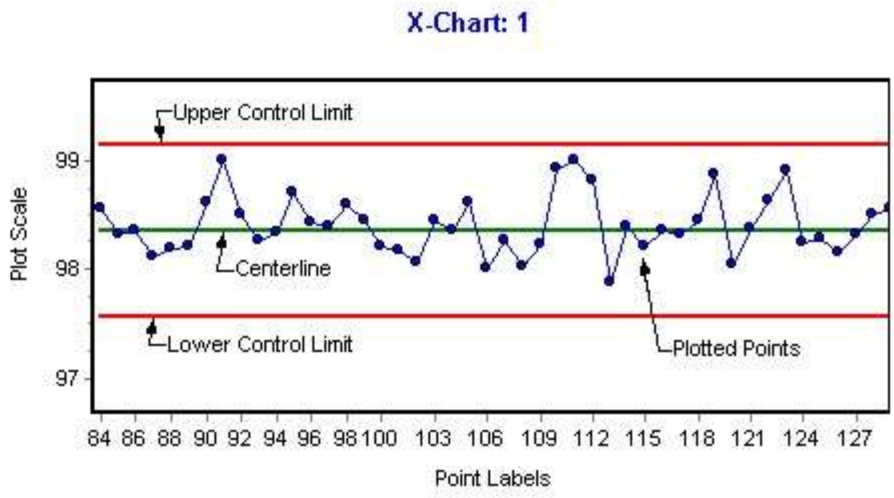

Figure 3. Sample Control Chart

Project monitoring and control utilize control charts to help determine statistical performance based on the establishment of upper and lower control limits. Ideally, data should flow along the centerline. In reality, internal and external factors can cause data to vary. The importance of this chart is the control limits. Should either limit be exceeded, project management can revisit the process for correction.

Histograms

Similar to a bar graph, in appearance, histograms provide a visual interpretation of numerical data by indicating the number of data points that lie within a range of values (Taylor, 2017). Data collected is used to describe the tendency with which an issue occurs. In other words, the statistical likelihood something will occur. Unlike a control chart, time has no influence over statistical probability (*PMI*, 2013, p. 238). *Figure 4* represents a sample histogram.

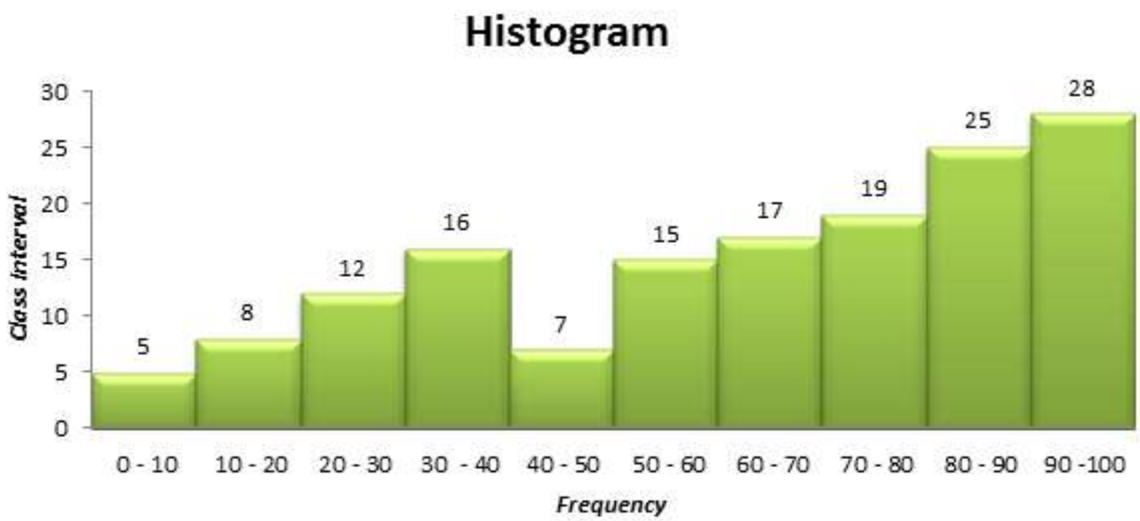

Figure 4. Sample Histogram Chart

As a monitoring tool, histograms provide a comparison between machines, people, and any other number of parameters that can be monitored. In the manufacturing environment, more than one shift exists to produce a given product. Data collected shift-to-shift can be documented, in histogram form, to aid in shift comparison. Comparing shift production is an excellent way of determining if a problem exists and if control measures warrant project management involvement.

Pareto Charts

Named after Alfredo Pareto, Pareto charts provide a graphical representation where the “vital few” causes are separated from the “trivial many” ("System Reliability Center (SRC)," 2004). Data collected is organized from most common defect to the least. This list does not take into account the cost associated with correct each defect. *Figure 5* represents a typical Pareto chart.

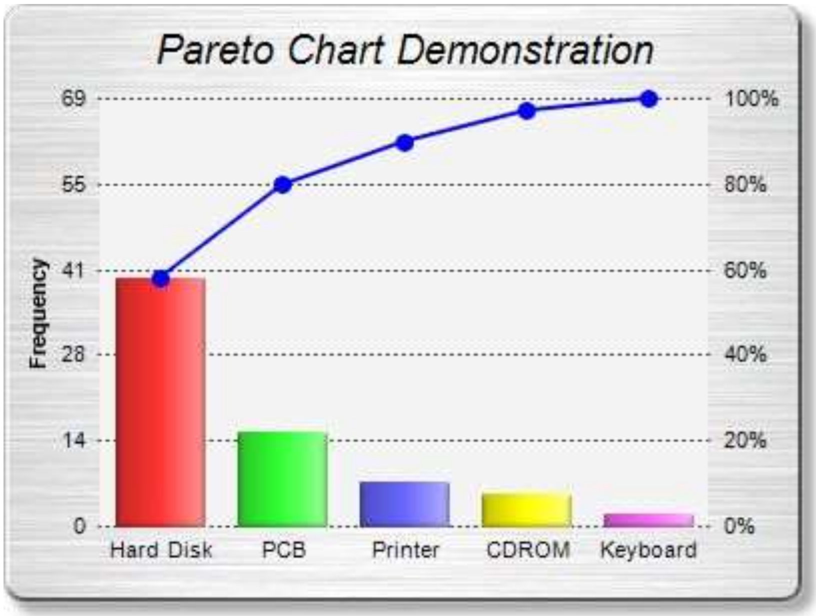

Figure 5. Sample Pareto Chart

Controlling and monitoring any project requires the ability to identify defects and move to correct them promptly. Collected data, displayed on a Pareto Chart, helps project management identify those defects, or issues, in need of immediate attention. The example provided indicates a hard disk issue occurring at almost 60% of the time. This defect is having the greatest impact and therefore must be corrected first. The use of a Pareto chart helps prioritize defects based on the frequency of occurrence.

Scatter Plots

Scatter plots provide a graphical representation are related to one another ("System Reliability Center (SRC)," 2004, p. 8). These plots are not intended to provide statistical probability, but rather the relationship between parameters. *Figure 6* is a sample scatter plot in which a vehicle's weight and miles per gallon are represented. The graph indicates that a vehicles mile per gallon rating is in direct relationship with its weight.

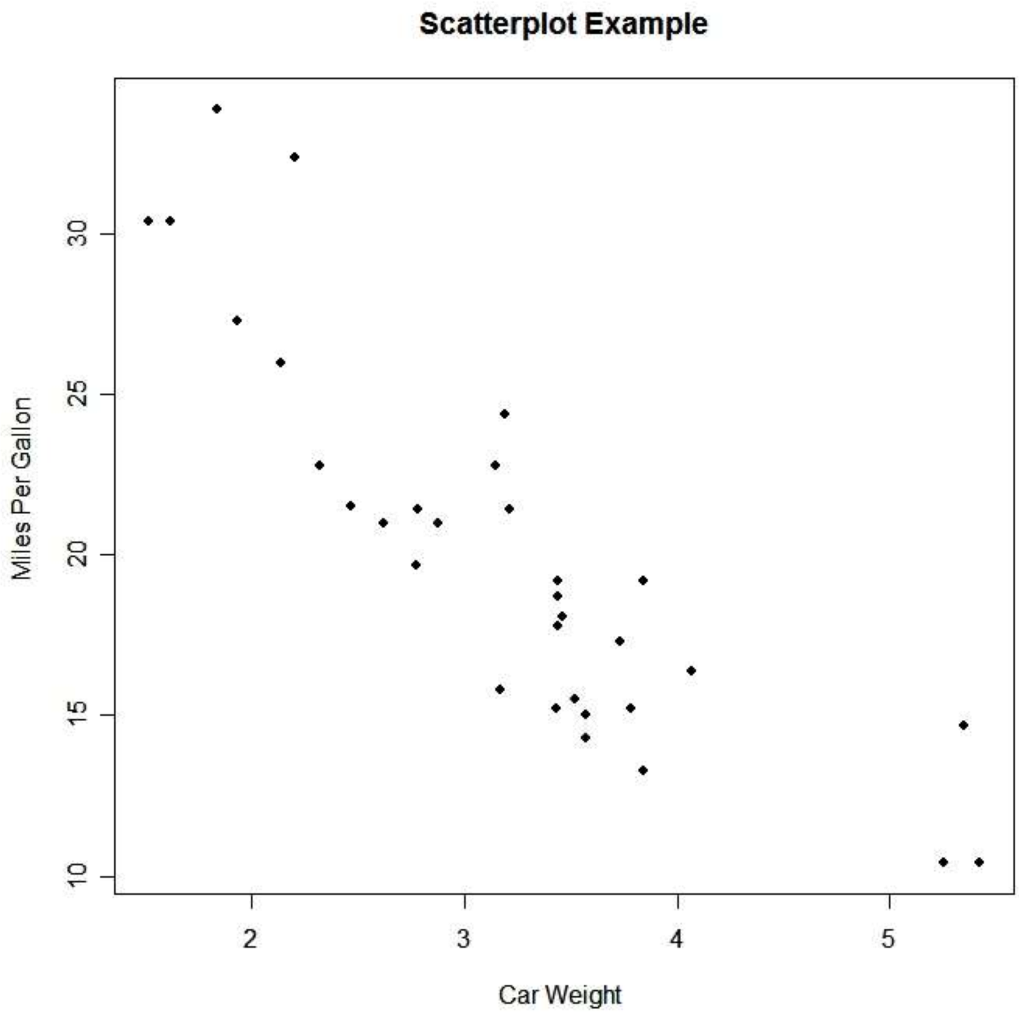

Figure 6. Sample Scatter Plot (Vehicle Weight vs. Mileage)

Monitoring and controlling projects often require an understanding of parameters and their relationship to one another. Example: An electronic circuit board manufacturer is noting a higher than normal failure rate of their solder connections. Several tests and adjustments are made, and it is determined that when the solder wave temperature is lowered, to save on electricity, cold solder connections become more frequent. On a scatter plot, data collected would indicate a direct relation between wave temperature and defects. This type of data is invaluable to project management.

Flow Charts

Flowcharts, also known as process maps, provide a step-by-step sequence of events to perform, and their possible output options (*PMI*, 2013, p. 236). Each flowchart activity is a prerequisite for the next and serves as the decision point in where to go next. Useful in understanding and estimating, the flow chart provides a step-by-step process to be followed. *Figure 7* is an example of a flow chart and the directions to take, based on the decision points.

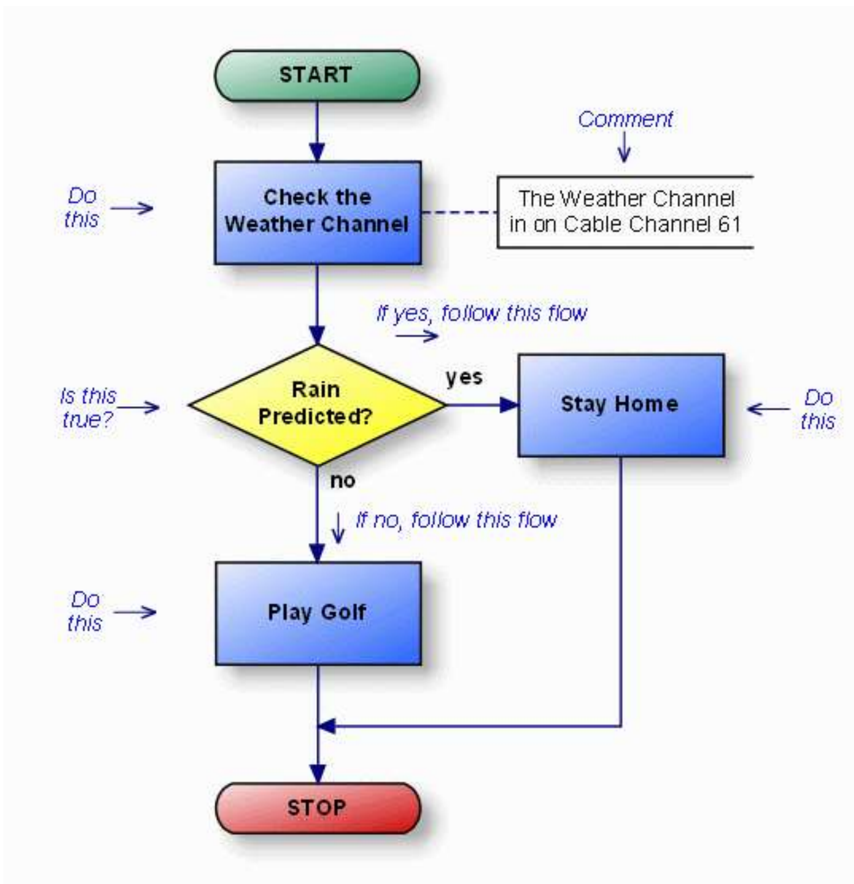

Figure 7. Sample Flow Chart

Monitoring and controlling projects throughout the project lifecycle is an orchestrated series of events set in a flow chart, from project initiation through closing. Each phase of the project is a series of flow steps and decisions. Monitoring the project lifecycle involves monitoring more than each activity, it means monitoring the whole process. Should any part of the process fail to meet objectives, then controlling measures must be enacted to restore the original flow.

Conclusion

The Seven Quality Concepts (7QC) are a series of tools designed for the everyday person to be able to use. Each tool by itself provides valuable information, but together become an impenetrable wall of quality control to ensure success. Kaoru Ishikawa contends that 95% of a company's problems can be solved by using these seven tools ("System Reliability Center (SRC)," 2004, p. 1). If the topic of quality control was graphed as one element of project failure, would the Pareto chart indicate this as one of the "vital few." I would suspect so.

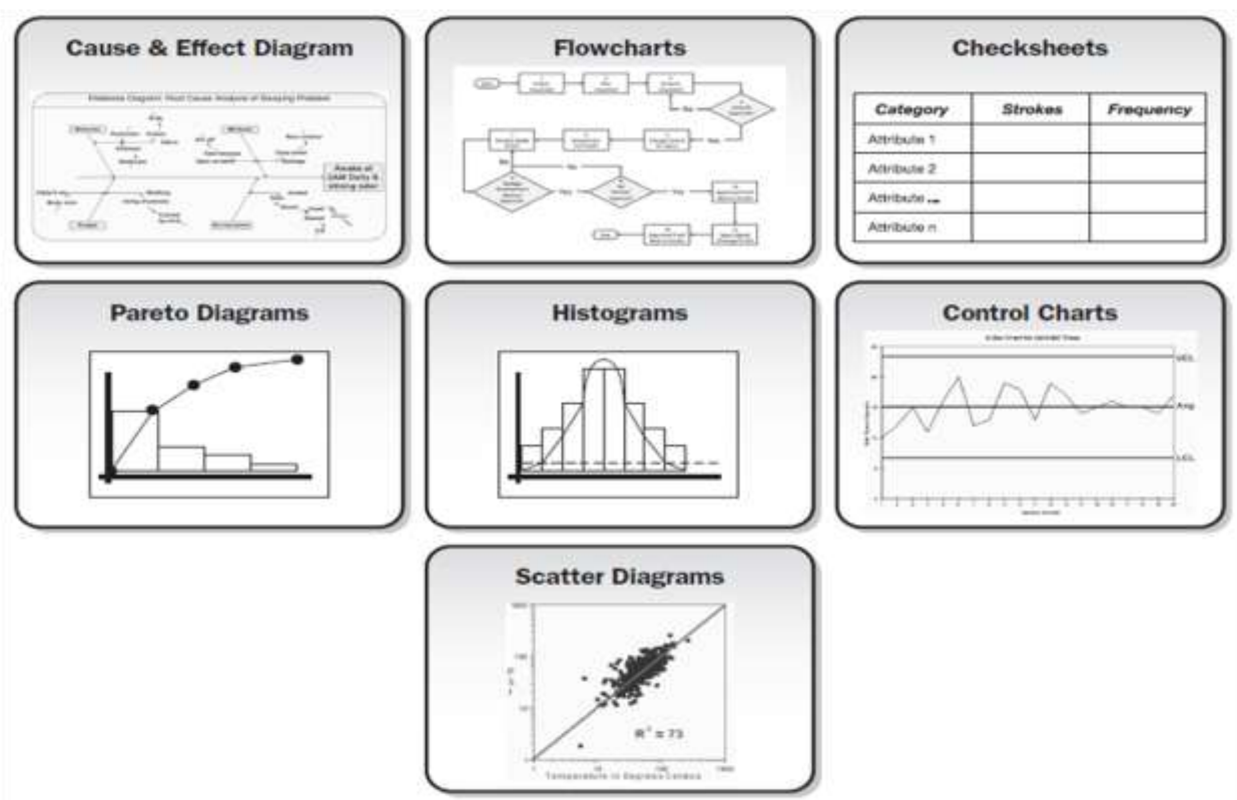

Figure 8. Seven Quality Tools

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