800-015-12-A: QUALITY IMPROVEMENT (QI) TOOLBOX
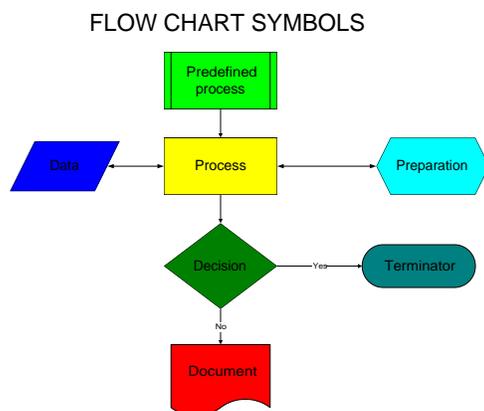
The complete LeanOhio Tool Kit is available at the following website link:
http://lean.ohio.gov/resources.aspx

Below is a list of commonly used QI Tools:

a. **Flow charting:** Use of a diagram in which graphic symbols depict the nature and flow of the steps in a process. This tool is particularly useful in the early stages of a project to help the team understand how the process currently works. The "as-is" flow chart may be compared to how the process is intended to work. At the end of the project, the team may want to then re-plot the modified process to show how the redefined process should occur. The benefits of a flow chart are that it:

1) Is a pictorial representation that promotes understanding of the process?
2) Is a potential training tool for employees?
3) Clearly shows where problem areas and processes for improvement are.

FLOW CHART SYMBOLS

Flow charting allows the team to identify the actual flow-of-event sequence in a process.

b. **Brainstorming:** A tool used by teams to bring out the ideas of each individual and present them in an orderly fashion to the rest of the team. Essential to brainstorming is to provide an environment free of criticism. Team members generate issues and agree to "defer judgement" on the relative value of each idea. Brainstorming is used when one wants to generate a large number of ideas about issues to tackle, possible causes, approaches to use or actions to take. The advantages of brainstorming are that it:

1) Encourages creativity.
2) Rapidly produces a large number of ideas.
3) Equalizes involvement by all team members.
4) Fosters a sense of ownership in the final decision as all members actively participate.
5) Provides input to other tools: "brain stormed" ideas can be put into an affinity diagram or they can be reduced by multi-voting.

c. **Decision-making tools:** While not all decisions are made by teams, two tools can be helpful when teams need to make decisions.

1) Multi-voting is a group decision-making technique used to reduce a long list of items to a manageable number by means of a structured series of votes. The result is a short list identifying what is important to the team. Multi-voting is used to reduce a long list of ideas and assign priorities quickly with a high degree of team agreement.
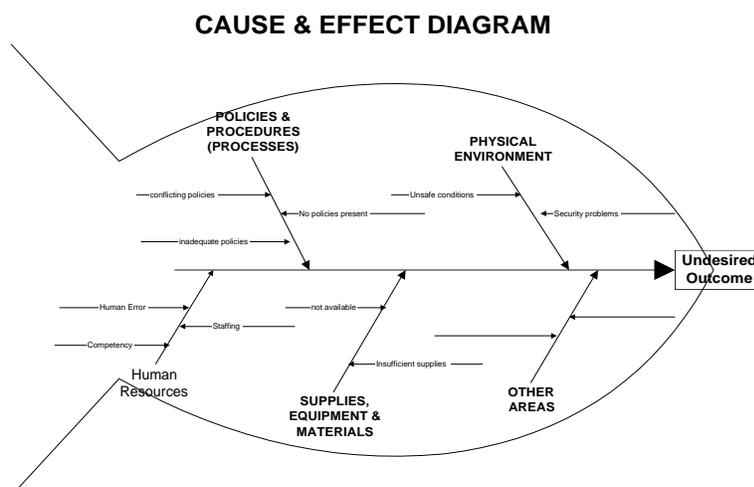2) Nominal Group technique-used to identify and rank issues.

d. **Affinity Diagram:** The Affinity Diagram is often used to group ideas generated by brainstorming. It is a tool that gathers large amounts of language data (ideas, issues, opinions) and organizes them into groupings based on their natural relationship. The affinity process is a good way to get people who work on a creative level to address difficult, confusing, unknown or disorganized issues. The affinity process is formalized in a graphic representation called an Affinity Diagram. This process is useful to:

1) Sift through large volumes of data.
2) Encourage new patterns of thinking.

As a rule of thumb, if less than 15 items of information have been identified; the affinity process is not needed.

e. **Cause and Effect Diagram (also called a fishbone or Ishakawa diagram):** This is a tool that helps identify, sort and display. It is a graphic representation of the relationship between a given outcome and all the factors that influence the outcome. This tool helps to identify the basic root causes of a problem. The structure of the diagram helps team members think in a very systematic way. The benefits of a cause-and-effect diagram are that it:

1) Helps the team to determine the root causes of a problem or quality characteristic using a structured approach.
2) Encourages group participation and utilizes group knowledge of the process.
3) Uses an orderly, easy-to-read format to diagram cause-and-effect relationships.
4) Indicates possible causes of variation in a process.
5) Increases knowledge of the process.
6) Identifies areas where data should be collected for additional study.

CAUSE & EFFECT DIAGRAM

Cause and effect diagrams allow the team to identify and graphically display all possible causes related to a process, procedure or system failure.

f.   **Histogram:** This is a vertical bar chart which depicts the distribution of a data set at a single point in time. A histogram facilitates the display of a large set of measurements presented in a table, showing where the majority of values fall in a measurement scale and the amount of variation. The histogram is used in the following situations:

1) To graphically represent a large data set by adding specification limits one can compare;
2) To process results and readily determine if a current process was able to produce positive results assist with decision-making.

g.   **Pareto Chart:** Named after the Pareto Principle which indicates that 80% of the trouble comes from 20% of the problems. It is a series of bars on a graph, arranged in descending order of frequency. The height of each bar reflects the frequency of an item. Pareto charts are useful throughout the performance improvement process - helping to identify which problems need further study, which causes to address first and which are the "biggest problems." Benefits and advantages include:

1) Focus on most important factors and help to build consensus.
2) Allows for allocation of limited resources.

The "Pareto Principle" says 20% of the source causes 80% of the problem. Pareto charts allow the team to graphically focus on the areas and issues where the greatest opportunities to improve performance exists.

h.   **Run Chart:** Most basic tool to show how a process performs over time. Data points are plotted in temporal order on a line graph. Run charts are most effectively used to assess and achieve process stability by graphically depicting signals of variation. A run chart can help to determine whether or not a process is stable, consistent and predictable. Simple statistics such as median and range may also be displayed. The run chart is most helpful in:
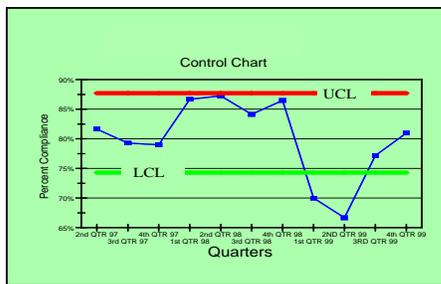
1) Understanding variation in process performance.
2) Monitoring process performance over time to detect signals of change.
3) Depicting how a process performed over time, including variation.

Allows the team to see changes in performance over time. The diagram can include a trend line to identify possible changes in performance.
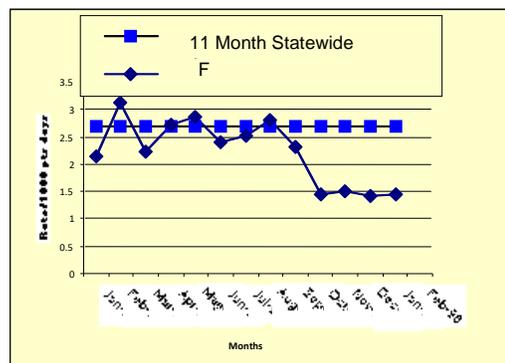
i.   **Control Chart:** A control chart is a statistical tool used to distinguish between variation in a process resulting from common causes and variation resulting from special causes. It is noted that there is variation in every process, some the result of causes not normally present in the process (special cause variation). Common cause variation is variation that results simply from the numerous, ever-present differences in the process. Control charts can help to maintain stability in a process by depicting when a process may be affected by special causes. The consistency of a process is usually characterized by showing if data fall within control limits based on plus or minus specific standard deviations from the center line. Control charts are used to:

1)   Monitor process variation over time.
2)   Help to differentiate between special and common cause variation.
3)   Assess the effectiveness of change on a process.
4)   Illustrate how a process performed during a specific period.

Using upper control limits (UCLs) and lower control limits (LCLs) that are statistically computed, the team can identify statistically significant changes in performance. This information can be used to identify opportunities to improve performance or measure the effectiveness of a change in a process, procedure, or system.

j.   **Bench Marking:** A benchmark is a point of reference by which something can be measured, compared or judged. It can be an industry standard against which a program indicator is monitored and found to be above, below or comparable to the benchmark.

k.   **Root Cause Analysis:** A root cause analysis is a systematic process for identifying the most basic factors/causes that underlie variation in performance. A common root cause analysis approach is the 5 Whys. To use the 5 whys, you do the following:

1)   Once you have identified a problem, ask the question "Why did this problem occur?" There may be multiple answers to that question.
2)   Then take each of the answers and ask the question again.
3)   Continue to do this until you have uncovered the possible root causes of the problem. It may be necessary to ask "why" several times (about five) before you uncover the root causes.