STRATEGIC PLANNING TOOLS

(Adapted from U.S. Coast Guard Leadership Development Center (2006).
Performance Improvement Guide. Boston, MA.: U.S. Government Printing
Office)

As used here, "tools" refers to techniques used to guide and organize group or individual thoughts. Successful groups or individuals must become adept at identifying the most effective tool for a given situation.

A cornerstone of any performance improvement initiative is to get the ideas of the people involved. People get excited about contributing to efforts that make things better, especially when those efforts involve their work areas or processes. The tools and techniques presented in this section will help you:

- Identify customer requirements
- Generate ideas
- Pare down a list of ideas
- Prioritize ideas
- Make decisions
- Collect, display, and analyze data
- Plan effectively

Action Planning

What is it: Often, projects evolve from meeting discussions and decisions. Action planning helps ensure that what is decided upon actually gets done.

How to use it:

Top section:
When a decision is made at your meeting that a certain project or task needs to be done, write the project description in the *Action Item* box. Extra action planning sheets may be used for large projects. Then, in the box *What Demonstrates Completion*, identify specific outcomes. Finally, in the Champion box, write in the name of the project manager, process owner, or person responsible for the overall task.

Bottom section:
Continue by listing each task description in the *Steps to Achieve Desired Outcome* column. Once a person is identified to spearhead the task, that person becomes accountable for ensuring that the task is completed and his or her name is written in the *Who* column. Finally, the deadline agreed upon by all concerned is written in the *When* column.

Helpful hints:

- To ensure accountability, use specific names and dates.
- Break work down into manageable chunks. The 80-hour rule is a rule-of-thumb that recommends assigning chunks that require less than 80 hours to complete.

Action Plan

Steps to Achieve Desired Outcome	Who	When
Action Item:		
What demonstrates completion:		
Champion:		

When using this approach, a good rule-of-thumb is to involve the person responsible for completion of a given project in deciding the *Steps to Achieve Desired Outcome* and *When* it gets done. Also, be sure to formally document the plan and periodically review its status with stakeholders.

Affinity Diagram

An affinity diagram organizes verbal information into a visual pattern. An affinity diagram starts with specific ideas and helps you work toward broad categories. This is the opposite of a cause-and-effect diagram, which starts with broad effects and works toward specific causes. Use either technique to explore all aspects of an issue. Affinity diagrams can help you:

- Organize a list of factors that contribute to a problem.
- Identify areas where improvement is most needed.

How to use it:

Identify the problem. Post the problem or issue in a location where all team members can see it.

Generate ideas. Use index cards or sticky-back notes to record the ideas.

Cluster your ideas (on cards or paper) into related groups. Use questions like "Which ideas are similar?" and "Is this idea somehow connected to any others?" to prompt ways to group ideas together.

Create affinity cards. For each group, create a card that has a short statement describing the entire group of ideas.

Cluster related affinity cards. Put all of the individual ideas in a group under their affinity card. Then group the affinity cards under even broader groups. Continue to group the cards until your grouping becomes too broad to have any meaning.
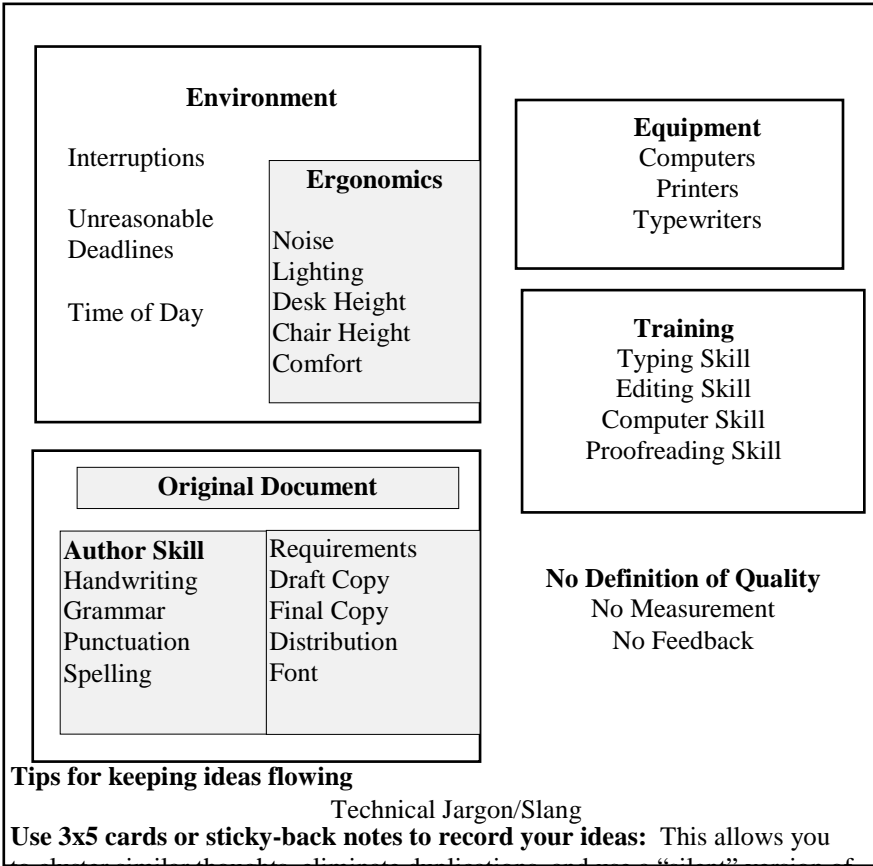
Create an affinity diagram. Post all of the ideas and affinity cards. Draw outlines of the groups with the affinity cards at the top of each group. The resulting hierarchical structure will give you valuable insight into the problem.

Affinity Diagram

A publication team wanted to reduce the number of typographical errors in their program's documentation. As part of a first step, they conducted a brainstorming session that produced the following list of factors that influenced errors.

Computers	No Feedback	Proofreading Skill
Lighting	Typewriters	Chair Height
Comfort	Desk Height	Time of Day
Technical Jargon	Interruptions	Handwriting
Grammar	Slang	Spelling
Draft Copy	Punctuation	Distribution
Font	Final Copy	Editing Skill
Computer Skill	Typing Skill	No Measurement
Printers	Unreasonable Deadlines	Noise

The following affinity diagram helped them to focus on areas for further analysis.

Environment

Interruptions

Unreasonable Deadlines

Time of Day

Ergonomics

Noise
Lighting
Desk Height
Chair Height
Comfort

Equipment
Computers
Printers
Typewriters

Training
Typing Skill
Editing Skill
Computer Skill
Proofreading Skill

Original Document

Author Skill	Requirements
Handwriting	Draft Copy
Grammar	Final Copy
Punctuation	Distribution
Spelling	Font

No Definition of Quality
No Measurement
No Feedback

Tips for keeping ideas flowing

Technical Jargon/Slang

Use 3x5 cards or sticky-back notes to record your ideas: This allows you to cluster similar thoughts, eliminate duplications, and use a "silent" version of any of the techniques listed in this section. This can be helpful when issues carry a lot of emotion.

Be creative! Don't limit suggestions or ideas early on in discussions. Encourage people to think creatively. Ask "What if?" and visualize the desired state if you could do anything you wanted. Ask "If I were the Commandant…"

During your idea-generating sessions:

- Change seats…views can be affected by where people sit in relation to others.
- Avoid cliques…encourage people to sit with those whom they don't know.
- Review the data or ideas periodically – encourage further input.
- Rotate groups and/or members to provide a fresh perspective.

Make it clear you want EVERYONE to participate!

- Create an open climate.
- Work to develop a group consensus.
- Don't evaluate…concentrate on getting many ideas.

HAVE FUN!

Brainstorming

Brainstorming is a technique, generally used in a group setting, to quickly generate a large number of ideas about a specific problem or topic. It can help encourage creative thinking and generate enthusiasm, as well as avoid the "paralysis of analysis" by holding the evaluation of ideas until a group has identified different possibilities.

How to do it:

The goal of brainstorming is to generate ideas. Before you start, remind everyone in your group to postpone judgment until after the brainstorming session is completed.

- Post the problem or topic where all participants can see it.
- Write all ideas on the board and do as little editing as possible.

There are three different types of brainstorming techniques: structured, unstructured, and silent. Each technique has different pros and cons.

In structured brainstorming:

- Solicit one idea from each person in sequence.
- Participants who do not have an idea at the moment may say "pass."
- Each person has an equal chance to participate, regardless of rank or personality.
- Spontaneity can be limited. It can sometimes feel rigid and restrictive.

In unstructured brainstorming:

- Participants simply contribute ideas as they come to mind and can build off each other's ideas. The atmosphere is very relaxed.
- Less assertive or lower-ranking participants might not contribute.

In silent brainstorming:

- Participants may write ideas individually on Post-It® notes or small slips of paper. Collect the papers and post them for all to see.
- Individuals cannot make disruptive "analysis" comments during the brainstorming session and the process provides confidentiality. This can help prevent a group from being overly influenced by a single participant or common flow of ideas.
- The group can lose the synergy that comes from an open session.

An ideal approach is to combine two of these methods. For example, begin the session with a round of silent or structured brainstorming, then finish with an unstructured period.

The result of a brainstorming session is a list of ideas. If this list is too long, the group can pare it down with a tool such as multi-voting or prioritize it with a tool such as nominal group technique.

Points To Remember About Brainstorming:

Never judge ideas as they are generated. The goal of brainstorming is to generate a lot of ideas in a short time. Analysis of these ideas is a separate process.

Do not quit at the first lull. All brainstorming sessions reach lulls, which are uncomfortable for the participants. Research indicates most of the best ideas occur during the last part of a session. Encourage the group to push through at least two or three lulls.

Try to write down all of the ideas as they were presented. When you condense an idea to one or two words for ease of recording, you are doing analysis. Analysis should be done later.

Encourage outrageous ideas. While these ideas may not be practical, they may spur a flow of creative ideas. This can help the group break through a lull.

Try to have a diverse group. Involve process owners, customers, and suppliers to obtain a diverse set of ideas.

After brainstorming:

- Reduce your list to the most important items.
- Combine items that are similar.
- Discuss each item on its own merits.
- Eliminate items that may not apply to original issue or topic.
- Give each person one final chance to add items.

Charter

A charter is a tool that can help groups:

- Determine a business case for a project
- Define the problem
- Focus the goal
- Establish project scope
- Facilitate buy-in from key stakeholders
- Identify project milestones, metrics, and resources
- Clarify linkages to strategic and mission objectives
- Identify if others are working or have worked on the problem
- Identify potential aids or barriers

There are many different styles of charters, but most have the same basic information:

Title:
- ❑ Team Name – Be descriptive

Key Stakeholders:
- ❑ Those key individuals or constituent groups that will be affected by or can impact the success of the project

Champion:
- ❑ Senior leader and project sponsor

Problem Statement:
- ❑ Describe what is wrong: "The Pain"
- ❑ When and where do problems occur?
- ❑ What is the size and impact of problem?
- ❑ Use specific business metrics.
- ❑ Would customers be happy if they know we are working on this?

Goal Statement:
- Define the improvement objective for Critical to Quality.
- Start with a verb – Reduce, Eliminate, Control, Increase.
- Tends to start broadly – Should include measurable target. Should NOT prescribe solution.

Business Case and Project Scope:
- Why is project worth doing?
- How does this positively impact our clients?
- What is the bottom-line financial impact?
- What process is being improved?
- Why is it important to do now?
- What are the consequences of not doing?
- How does this fit within the business or process priorities?

Scope:
- What are the boundaries of the process?
- What is out of bounds for the project?

Project Milestones / Metrics / Resources:

Milestones:
- Discuss project milestones and dates.
- Discuss key dependencies and other matters that affect project execution.

Metrics:
- Specify the primary and secondary metrics for the project.

Resources:
- Who will need to be on the team?
- What resources will be needed other than money?

Background:

What Strategic Objective does this project help drive?
- ❑ List the Strategic Objective(s) this project helps drive / accomplish.

What Mission Objective does this link to?
- ❑ List the specific Mission Objective(s) this project directly links to.

Is anyone else working or has anyone worked on this problem/opportunity?
- ❑ Yes/No (All project sponsors or project managers must ensure that this is not a duplicative effort.)

Where did you look?
- ❑ List the other contacts that you checked with to ensure that this is not duplicative work.

What did you find?
- ❑ Briefly state what was learned.

Aids:
- ❑ What will help this project be successful?

Barriers:
- ❑ What will hinder success?

Cause-and-Effect Diagram

A cause-and-effect diagram graphically illustrates the relationship between a given outcome and all the factors that influence this outcome. Sometimes called an Ishikawa or "fishbone" diagram, it helps show the relationship of the parts (and sub-parts) to the whole by:

- Determining the root causes of a problem.
- Focusing on a specific issue without resorting to complaints and irrelevant discussion.
- Identifying areas where there is a lack of data.

How to use it:

Specify the problem to be analyzed. State the problem in quantitative terms (e.g., "50% of employee performance reviews are not submitted on time). This helps teams avoid finger pointing by focusing on facts rather than opinions. Place the problem statement in a box on the right side of the diagram. Then list the major categories of the factors that influence the effect being studied. The "6 Ms" [methods, manpower (personnel), materials, machinery, Mother Nature (environment), and measures] are commonly used as a starting point: These six categories are six key sources of variation in any process.
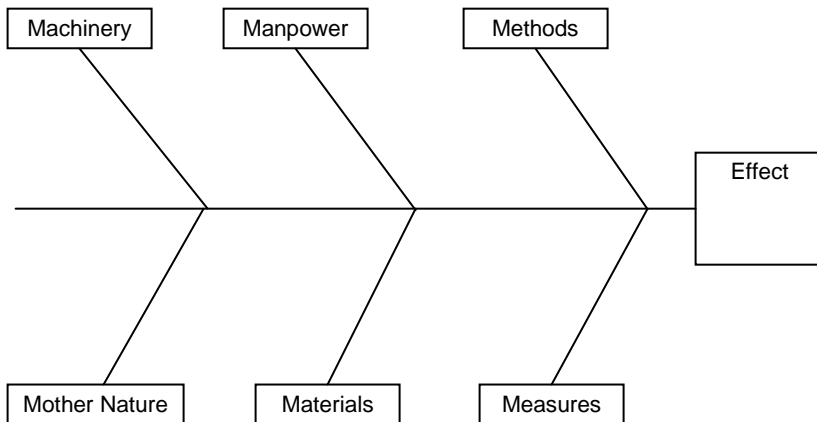
Identify factors and sub factors. Use an idea-generating technique to identify the factors and sub-factors within each major category. An easy way to begin is to use the major categories as a catalyst. For example, "What methods are causing…?" Keep asking "why?" to flush out root causes.
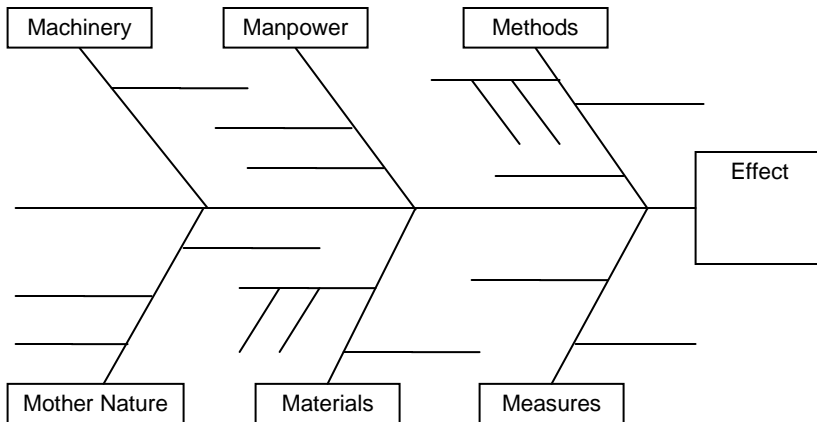
Identify significant factors. Look for factors that appear repeatedly or have a significant effect according to data available. A sub-factor may be the root cause of all your problems. You may also decide to collect more data on a factor that had not been previously identified.

Check Sheet

A check sheet is a form you can use to collect data in an organized manner and convert it into readily useful information like Pareto charts or histograms. With a check sheet, you can:

- Collect data with minimal effort.
- Convert raw data into useful information.
- Translate opinions of what is happening into what is actually happening. In other words, "I think the problem is…" becomes "The data says the problem is…."

How to use it:

Clearly identify what is being observed. The events being observed should be clearly labeled. Everyone has to be looking for the same thing.

Keep the data collection process as easy as possible. Collecting data should not become a job in and of itself. Look for the easiest approach; simple check marks are easy.

Group the data. Collected data should be grouped in a way that makes the data valuable and reliable. Similar problems must be in similar groups.

Be creative. Try to create a format that will give you the most information with the least amount of effort.

Check Sheet
Help Desk Complaints

	Mon	Tue	Wed	Thu	Fri	Totals
Long wait	⊺Ɪ⊦Ɪ III	IIII	II		II	16
Poor customer service	⊺Ɪ⊦Ɪ I	II	III	II	II	15
No help	IIII	I	I		I	7
Totals	18	7	6	2	5	38

Consensus Cards

Consensus cards allow team leaders, facilitators, and group members to visually see where the group stands on an issue; help a group examine all viewpoints; and keep the group focused.

How to use them:

Simply buy enough four-color packs of 3" X 5" recipe cards so that each person gets one card of each color. Typically, the cards come in green, yellow, red, and either blue or purple. Assign uses to each color as listed in the table below.

Consensus Cards	
Color	**Use**
Green	Agree, "I can support this."
Yellow	Unsure or need more information
Red	Disagree, "I can't support this."
Orange	We're getting off topic, on a tangent
Blue or Purple	Wildcard, use for breaks or when groups are beating a dead horse.

Ask group members to weigh in on an issue by holding up a green, yellow, or red card, as appropriate. Require that all members hold up a card. This ensures that those who are on the fence make a choice.

A good approach is to allow the minority, which will often hold yellow or red cards, to voice their perspective. Explore the reasons that they are unsure or disagree with the issue. Allowing the minority to state their viewpoint may help the group develop a solution that is inclusive of many perspectives and avoid groupthink. A key facilitative question to ask is "What concern, if addressed, would cause you to change your yellow vote to green or red vote to yellow?"

The Wildcard

Using a wildcard, such as a blue or purple card, can remind groups that they are overdue for a break or signal the group that the discussion is heading into the weeds.

Often a timekeeper will keep track of agreed-upon breaks. (An often-used rule-of-thumb is ten minutes of break for every fifty minutes of meeting.) Sometimes, however, the group will get engaged and forget the time. A blue or purple card can serve as a reminder to take time to recharge.

When used as a "beating a dead horse" card, the blue or purple card can signal that it is time to move on. A good approach is to let the person talking finish their thought, then ask the group if the issue has been sufficiently addressed, needs to be discussed further, or placed in the parking lot.

Contingency Diagram

The contingency diagram is a way to capitalize on negative thought. It helps leaders consider all the potential negative "contingencies" of a future goal or program. Also, by thinking of all the ways a problem can get worse or continue unchecked, a group can develop an action plan to overcome any barriers.

How to use it:

Step 1. Place a goal or problem in the center circle.
Step 2. Draw lines outward from the circle and brainstorm:
- o What will cause this situation to get worse or continue?
- o What will prevent (or sabotage) your desired state?

Lack of qualified people

Surge operations

Over-tasking of personnel during break-in period

Large number of leave requests

Implement new duty schedule

Emergent situations

Gaps between departing and arriving personnel

TDY assignments

Poor schedule management
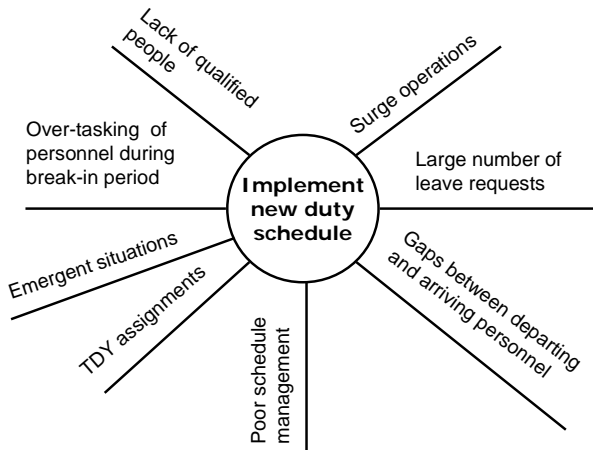
Step 3. Formulate a plan with specific actions to prevent these obstacles.

A prevention/action checklist can be developed by taking each obstacle identified and brainstorming ways to prevent it from happening. Here is an example using some of the obstacles identified in the contingency diagram:

Prevention/Action Checklist	
Obstacles	*Corrective Actions*
A. Poor scheduling	1. Set a deadline for input prior to scheduling. 2. Identify when personnel are not available. 3. Assign standby in case of emergent issues.
B. Over-tasking of personnel during break-in period	1. Modify the break-in process to have reporting personnel break-in full time under the guidance of the duty supervisor. This will shorten the cycle time of the process and increase the number of qualified personnel. 2. Monitor the break-in process through measures of efficiency and effectiveness. Communicate these measures to the crew.
C. Gaps between arriving and departing personnel	1. Identify potential gaps by systematically reviewing career intention worksheets and e-resumes. Post transfer dates on the unit's master calendar to create a clear picture. 2. Use the command concerns process to communicate unit needs to detailers before the transfer season. 3. Monitor the number of filled billets and quality-of-match and communicate these measures to the crew.

Plans such as this can help leaders define or improve a process, as well as address any gaps that may exist in the implementation of a future program. See the section on performance improvement for more information.

Control Charts

Control charts are the next step from run charts; they help users determine if a process is in Statistical Process Control (SPC). Control charts use mathematically derived upper and lower control limits. Statistically, 99.73% of all stable process results fall between these limits. Control charts show unwanted process changes that appear as abnormal points on a chart. The process is said to be in "statistical control" when the data vary randomly within the upper and lower control limits.

Control limits are not tolerance or specification limits; rather, they are mathematical functions of how a process actually performs. Thus, it is possible for a process to be in statistical control but operate outside tolerance.

The control chart type you use depends on the type of data you collect. There are several types of control charts; each has an appropriate use and inherent strengths and weaknesses. Control chart selection is beyond the scope of the PIG; however, the X-Bar chart on the next page is an example of the most commonly used chart and shows individual process outputs.

The chart, with upper and lower limits, shows that the (fictitious) maximum time to get underway is 21 minutes—within the upper limit. However, it is probable that this process will generate a result that is unsatisfactory to USCG standards. To prevent such an occurrence, this cutter would need to change its process.

While the most common sign of special cause variation is having a single point above or below the upper and lower control limits, there are other indicators. These observations indicate the presence of special cause variation:

- ☒ 1 or more points outside the control limits.
- ☒ 7 or more consecutive points on one side of the centerline.
- ☒ 6 points in a row steadily increasing or decreasing.
- ☒ 14 points alternating up and down.

Special cause variation should be investigated and the cause removed if possible; however, process redesign is not required if the process is stable and within acceptable limits (standards). Treating special cause variation as common cause variation, and vice versa, can have disastrous effects on performance results.

The below chart shows the launch times for this unit have not been affected to date by special cause variation.
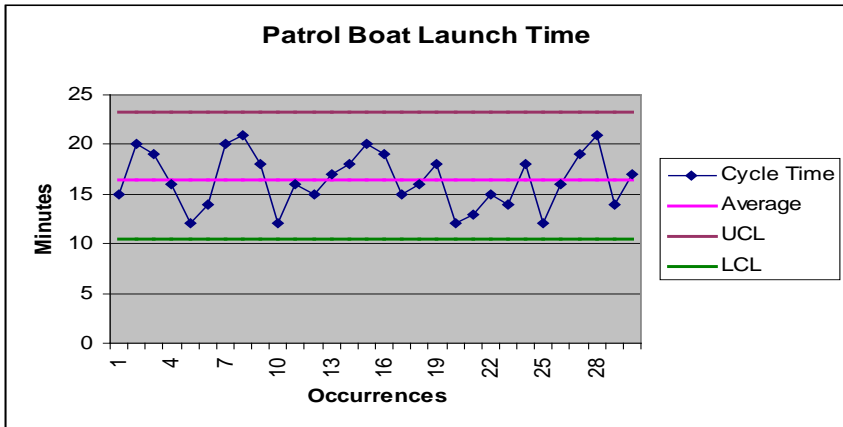
This chart shows the Coast Guard maximum limit is inside the control limits. It is likely this process will eventually produce a result that is unacceptable. Process redesign may be in order.
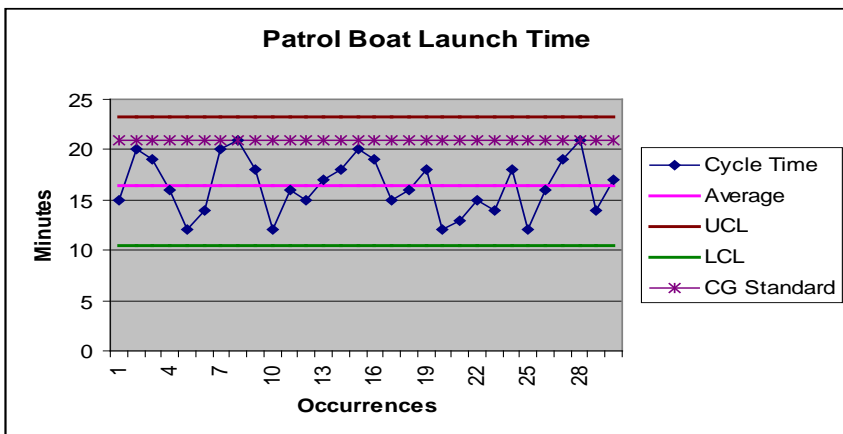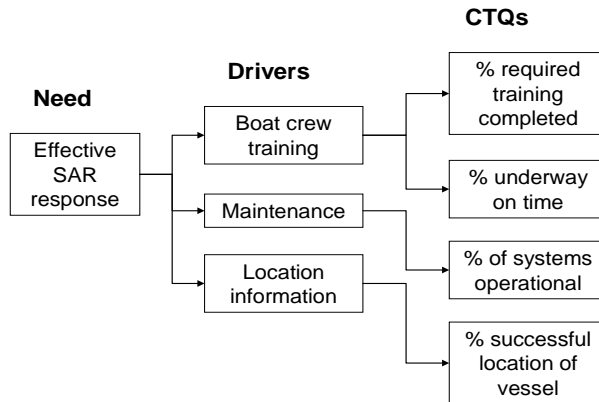
A critical-to-quality (CTQ) tree enables you to take a "soft" customer need and break it down into more tangible customer requirements.

How to use it:

Begin with an overall customer need. Examples of needs are on-time delivery, good customer service, or as illustrated below, effective search-and-rescue response. Then identify the key drivers that support your unit's ability to supply that need. Finally, identify the metrics that allow you to measure how well those drivers are performing. Use "hard" numbers such as wait time or number of defects over "soft" measures such as customer satisfaction survey response indicators. CTQ measures often provide input to a unit or workgroup's strategic planning process and can be used to drive process improvement projects.

Voice of the Customer, Critical-to-Quality (CTQ) Tree

CTQs

Drivers

Need

| Effective SAR response | Boat crew training | % required training completed |

% underway on time

Maintenance

% of systems operational

Location information

% successful location of vessel

Customer Alignment Questions

Customer alignment questions generate information about how well your processes meet your customer's needs. To establish some agreed-upon performance requirements, ask these four questions:

- What do you need from me?
- What do you do with what I give you?
- What are the gaps between what I provide and what you need?
- What do I give you that you do not want or need?

How to use them:

These questions will allow you to discover what your customer's needs, wants, and expectations may be for the service, product, or information you are supplying. By understanding how your customer is using your output, you can better align your process capabilities with what your customer wants. Knowing if there are gaps and what the impacts of those gaps are can provide improvement opportunities. Asking a customer what they don't want or need can help you reduce unnecessary work.

Once you obtain this information, you may want to establish a baseline to better determine which direction to take. You may also establish a formal, repetitive feedback system if it will help in continuous process improvement.

Customer Requirements Matrix

A customer requirements matrix can help suppliers identify the characteristics of a product or service that drive customer satisfaction and evaluate opportunities for improvement.

How to use it:

Begin by identifying quality characteristics—key requirements of a product or service as defined by the customer. Then, ask the customer to rate the importance and performance of each quality characteristic. Performance is a rating of how well you are doing as a supplier (see below example). Armed with knowledge in these areas, you can calculate the gaps in performance, and then multiply importance and the performance gap to identify opportunities for improvement.

Voice of the Customer, Customer Requirements Matrix

ISC Anywhere Dining Facility:

Quality Characteristic	Importance	Performance	Gap	Total
Healthy food choices	5	1	4	20
Hot food	5	3	2	10
Friendly service	3	3	2	6
Cleanliness	4	4	1	4
Appearance of physical facilities	2	4	1	2

Importance: 5 = very important, 1 = not very important
Performance: 5 = excellent, 1 = poor
Gap = top performance rating – performance rating
Total = importance x gap

Decision Matrix

A decision matrix, or prioritization matrix, is used for selecting one option from several possibilities. It involves selecting criteria by which the items will be judged and using them to make an acceptable decision. It can be used to choose a single problem or solution from a list.

How to use it:

Generate a list of options using an idea-generation tool, then pare the list down to a manageable few.

Choose criteria. Once the list of criteria is generated, the team needs to discuss and refine the list to the five or six that the team believes are the most important. Often-used criteria include:

- Effectiveness
- Feasibility
- Capability
- Time requirements
- Cost
- Enthusiasm (of the team and of others)

Weight the Criteria. After the criteria are identified, the team assigns a relative weight to each criterion based on how important that criterion is to the situation. There are different ways the solutions can be graded against the criteria. One way is to answer with a yes/no, but problems might arise if two different solutions receive the same number of yes/no votes.

Another way is to rate the criteria on a scale in relation to each of the options. The option with the highest, or lowest depending on the scale used, point total might be the option the group decides to focus on first.

Draw a grid. Create the grid with the criteria across the top and the options along the left side.

Decision Matrix Example

	Criteria #1 (weight value)	Criteria #2 (weight value)	Criteria #3 (weight value)	Score
Solution #1				
Solution #2				
Solution #3				

Evaluate Choices. Evaluate each choice against the criteria.

Calculate Weight Values. Multiply each choice's rating by the weight. As Nancy Tague states in her book *The Quality Toolbox,* "The choice with the highest score will not necessarily be the one to choose, but the relative scores can generate meaningful discussion and lead the team toward consensus."

Flowchart

A flowchart is a graphic representation of the major steps of a process. It can help you:

- Understand the complete process.
- Identify the critical stages of a process.
- Locate problem areas.
- Show relationships between different steps in a process.

How to use it:

Identify the process. Define the start point and finish point for the process to be examined. It is sometimes helpful to refer back to the SIPOC model to do this on a macro level.

Describe the current process. Lay out all the process steps from beginning to end. Use the symbols shown on the next page to improve clarity.

(Optional) Chart the ideal process. Try to identify the easiest and most efficient way to go from the start block to the finish block. While this step isn't absolutely necessary, it makes the next step easier.

Search for improvement opportunities. Identify the areas that hinder your process or add little or no value. If you did the optional step, examine all areas that differ from your ideal process and question why they exist. Consider measures of effectiveness and efficiency.
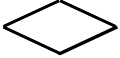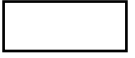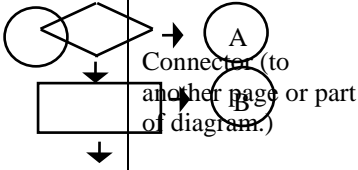
Update your chart. Build a new flowchart that corrects the problems you identified in the previous step.

Helpful hint:

Put the steps of your process on index cards or sticky notes. This lets you rearrange the diagram without erasing and redrawing.

Note: It is sometimes more efficient for the group to develop the major elements of the process than for an individual or sub-group to create a more detailed and aesthetically pleasing flowchart.

These are standard flowchart symbols:

This symbol...	Represents…	Some examples are…
⬭	Start/Stop	♦ Receive trouble report ♦ Receive input from supplier
◇	Decision Point	♦ Approve / Disapprove ♦ Accept / Reject ♦ Yes / No
▭	Activity	♦ Drop off travel voucher ♦ Open access panel
⬒	Document	♦ Fill out a trouble report
(diagram with circle, diamond, A, B connectors)	Connector (to another page or part of diagram.)	
⬭ (cylinder)	Database	♦ Coast Guard Business Intelligence (CGBI)

Flowchart Example

Before it was eventually replaced, a copy machine suffered frequent paper jams and became a notorious troublemaker. Often, a problem could be cleared by simply opening and closing the access panel. Someone observed the situation and flowcharted the troubleshooting procedure used by most people.
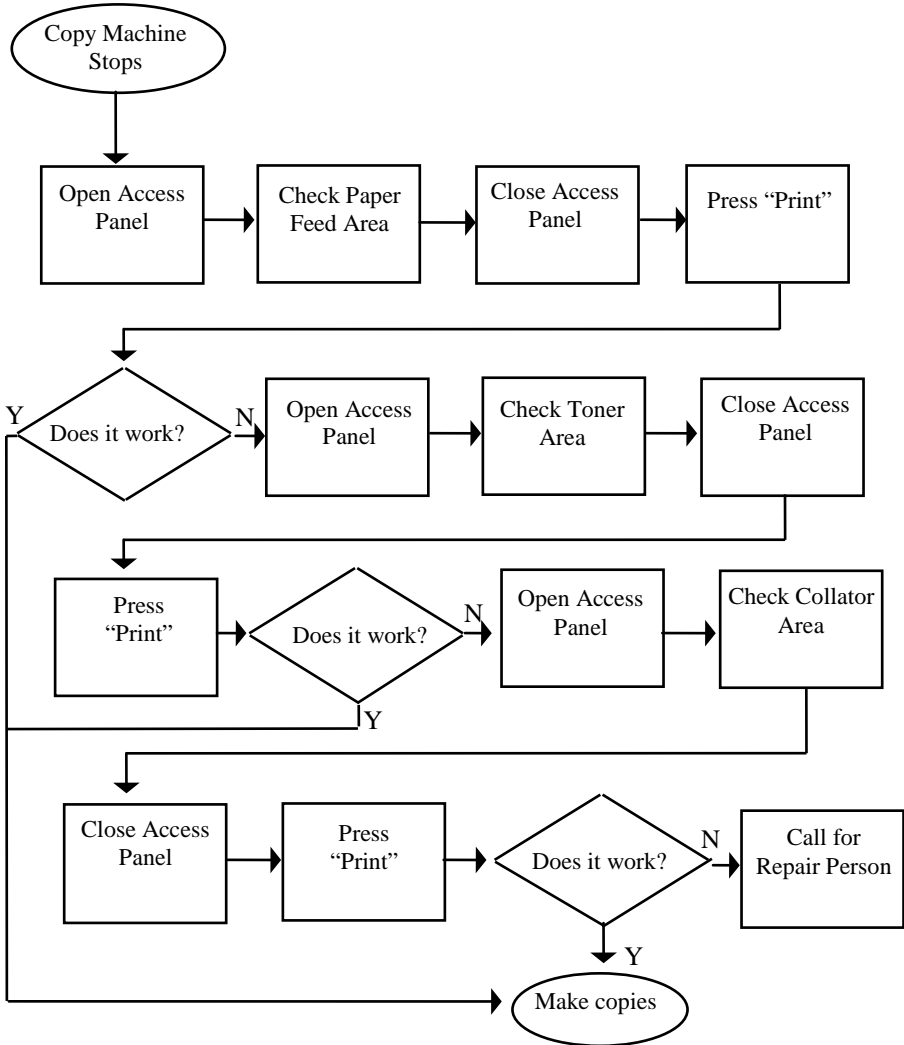
Force Field Analysis

Force field analysis helps identify key forces that promote or hinder the solution of a problem or the achievement of a goal.

How to use it:

Define the objective. Place the problem or goal to be analyzed in the upper right corner of the chart.

List the forces. List the key factors that promote or hinder the achievement or your goal or the resolution of your problem. Groups should use an idea-generation technique. Use two lists: one for promoting forces and one for hindering forces.

Prioritize. Prioritize the forces in each list according to their relative impact on the problem or goal. You can use nominal group technique or some other decision-making tool.

Implement. Create an action plan to minimize the key hindering forces and maximize the promoting ones.

Force Field Analysis Example:

Goal: Get a College Degree

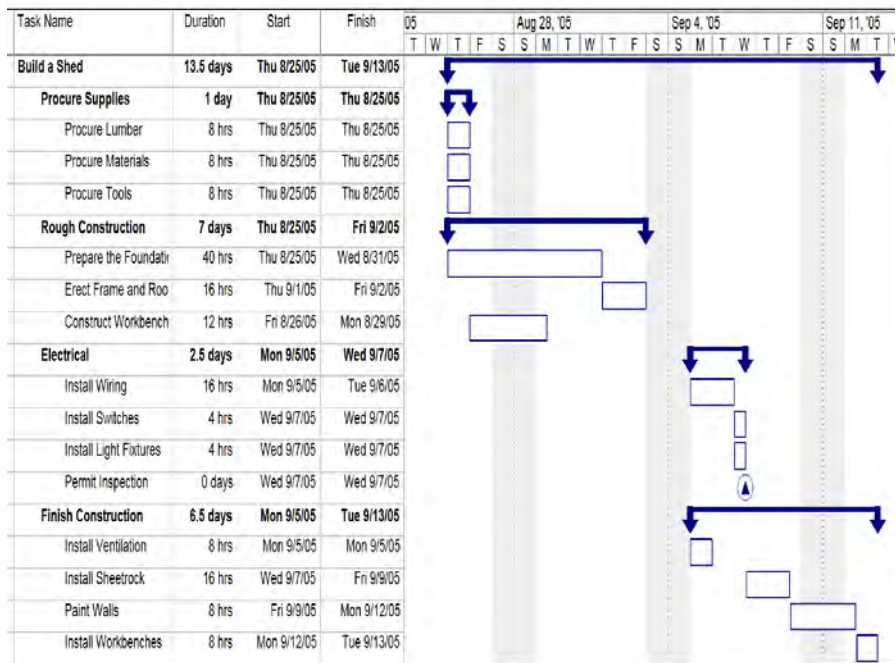| Promoting	Restraining
• Unit support	• Job responsibilities
• ESO support	• Operational tempo
• Tuition assistance	• Hard to study at home
• Family support	• Family responsibilities
• Credit for military experience & courses	• Poor study habits

Gantt Chart

A Gantt Chart depicts an overall project timeline, lists tasks required for project completion, and visually illustrates task dependencies. Project managers often include other key information such as task responsibilities (who is responsible for task completion) and resource requirements.

How to use it:

Begin by identifying the work that must be accomplished. Once the work is listed, plot the time required for each task. Be sure to note which tasks are dependent on others, and if the required resources are available at that time. The overall plot can help managers determine the total project time required and monitor task completion.

Task Name	Duration	Start	Finish
Build a Shed	13.5 days	Thu 8/25/05	Tue 9/13/05
Procure Supplies	1 day	Thu 8/25/05	Thu 8/25/05
Procure Lumber	8 hrs	Thu 8/25/05	Thu 8/25/05
Procure Materials	8 hrs	Thu 8/25/05	Thu 8/25/05
Procure Tools	8 hrs	Thu 8/25/05	Thu 8/25/05
Rough Construction	7 days	Thu 8/25/05	Fri 9/2/05
Prepare the Foundati	40 hrs	Thu 8/25/05	Wed 8/31/05
Erect Frame and Roo	16 hrs	Thu 9/1/05	Fri 9/2/05
Construct Workbench	12 hrs	Fri 8/26/05	Mon 8/29/05
Electrical	2.5 days	Mon 9/5/05	Wed 9/7/05
Install Wiring	16 hrs	Mon 9/5/05	Tue 9/6/05
Install Switches	4 hrs	Wed 9/7/05	Wed 9/7/05
Install Light Fixtures	4 hrs	Wed 9/7/05	Wed 9/7/05
Permit Inspection	0 days	Wed 9/7/05	Wed 9/7/05
Finish Construction	6.5 days	Mon 9/5/05	Tue 9/13/05
Install Ventilation	8 hrs	Mon 9/5/05	Mon 9/5/05
Install Sheetrock	16 hrs	Wed 9/7/05	Fri 9/9/05
Paint Walls	8 hrs	Fri 9/9/05	Mon 9/12/05
Install Workbenches	8 hrs	Mon 9/12/05	Tue 9/13/05

A histogram is a bar graph that shows the central tendency and variability of a data set. Histograms are sometimes referred to as frequency distributions. A histogram can help you:

- Understand the variability of a process.
- Quickly and easily determine the underlying distribution of a process.

How to use it:

Determine the type of data you want to collect. Be sure that the data is measurable (for example, time, length, speed, etc.).

Collect the data. Collect as many measurable data points as possible. Collect data on one parameter at a time. Check sheets may be used, but are not the only way to collect data for a histogram.

Count the total number of points you have collected.

Determine the number of intervals required. Use this table to determine how many intervals (or bars) the graph should have.

If you have this # of data points…	Then use this # of intervals
less than 50	5 - 7
50 - 99	6-10
100 - 249	7 - 12
More than 250	10 - 20

Determine the range. Subtract the smallest value in the data set from the largest. This value is the range of your data set.

Determine the interval width. Divide the range by the number of intervals. Round up your answers to a convenient value. For example, if the range of the data is 17 and you have decided to use 9 intervals, then your interval width is 1.88. You can round this to 1.9 or 2.0. It is helpful to have intervals defined to one more decimal place than the data collected.

Determine the starting point of each interval. Use the smallest data point value as the first interval starting point. The starting point for the second interval is the sum of the smallest data point plus the interval width. For example, if your smallest data point is 10 and the interval width is 2, then the starting point for the second interval is 12. Label intervals along the horizontal axis.

Plot the data. Count the number of data points that fall within each interval and plot this frequency on the histogram. Keep in mind that each data point can appear in only one interval. For example, if your first interval begins with 10.0 and the second with 12.0, then all data points that are equal to or greater than 10.0 and still less than 12.0 are counted in the first interval.
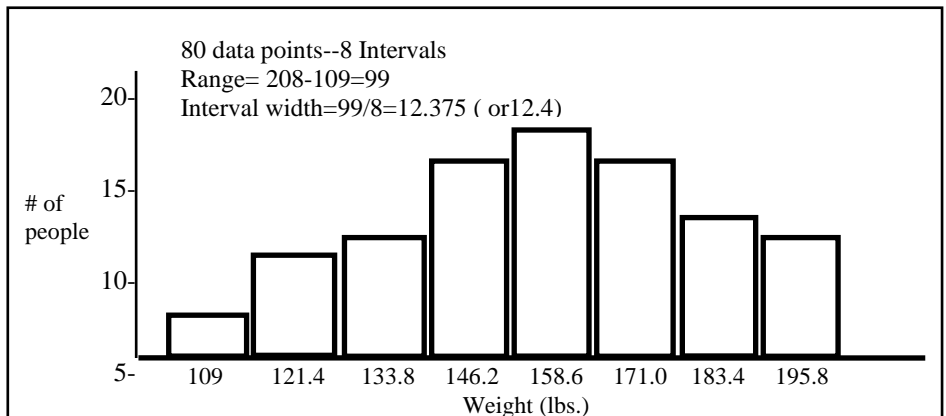
Points to remember:

- Each data point appears in one and only one interval.
- The number of intervals can influence the pattern your data will take.
- Don't expect the histogram to be a perfect bell curve; variations will occur. Ask yourself if the picture is reasonable and logical. And be careful not to let your preconceived ideas influence your decision unfairly.

Histogram Example

The weights of 80 Coast Guard members are laid out in this table:

208	180	159	163	159
155	180	165	149	127
159	171	141	190	159
153	181	180	137	161
115	156	173	165	191
159	109	179	145	144
150	206	166	188	165
127	130	172	180	147
145	150	156	171	189
190	200	208	169	139
130	128	155	185	166
165	187	159	178	169
147	150	201	128	170
189	163	150	158	180
139	149	185	129	169
175	189	150	201	175

The points are distributed on a histogram as follows:

80 data points--8 Intervals
Range= 208-109=99
Interval width=99/8=12.375 (or12.4)

# of people

Weight (lbs.)

36

Kano Model

The Kano model examines factors that contribute to customer satisfaction. Some factors, if not fulfilled, lead to dissatisfaction, but if fulfilled will not delight the customer. For example, if a car does not run or is not reliable, that will lead to dissatisfaction. However, a car that runs will not delight the average person.

There are also features where more is better, such as car features like air conditioning, power windows, seats, and door locks, a CD player, etc. These factors may lead to dissatisfaction, but also, in the case of a fully loaded car, contribute to delight.

Finally, there are delighters. In terms of today's cars, these might include GPS, luxury upgrades, or others that make the buyer say "Wow!" Delighters are determined by customers, not suppliers.

Next consider television sets. In the 1950s, few TVs had a remote control; remotes were delighters back then, especially for the kids who were constantly being told to get up and change the channel! Today a remote is a must-have item, not having one may lead to dissatisfaction, but having one

Kano Model

Customer Satisfaction

Delight

Delighters

More Is Better

Neutral

Must Be

Dissatisfaction

Absent ← → Fulfilled

Degree of Achievement

will not necessarily lead to delight—although features integrated into newer remotes may add that "Wow!" factor.
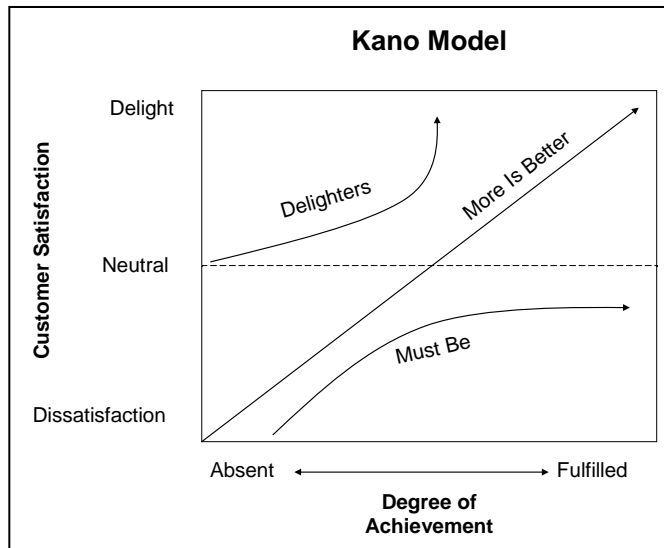
Multi-Voting

Multi-voting is a way for a group to determine which items in a list are most important. This technique helps you:

- Pare down a larger list into a manageable few
- Separate the vital few items from the important many

How to use it:

Combine like items. This prevents the splitting of votes for essentially the same thing.

Letter the choices. This makes tabulating the votes easier.

Use the half-and-half rule. Each person gets a number of votes equal to approximately half the number of items on the list (10 votes for a 20-item list). Then each person gets up to half the number of votes to place on any one item (if each person has 10 votes, then the maximum number they can assign to one item is five).

Vote. Have each member vote privately on a slip of paper for the items they believe have high priority.

Compile the votes given to each item. If planning is done beforehand, this can be time for a group break! You could put a mark beside each item for every vote it receives.

Reduce the list. Highlight the items that received the most votes.

Helpful hints: Multi-voting is best suited for larger groups and long lists. Its simplicity makes it quick and easy to use. Be sure to get consensus on the final results. This is not a final decision-making tool!

Multi-Voting Example

District staff elements attended a lot of meetings at different locations around their district. They complained because meetings conducted at these locations were not always as productive as they might have been. The Chief of Staff called a meeting to improve the situation. A brainstorming session produced the following list of reasons for unproductive meetings:

List of Reasons for Unproductive Meetings
A. No agendas
B. No clear objectives
C. Going on tangents
D. Too much time
E. Too much protocol/politics
F. Wrong people
G. Not enough data provided before meeting
H. No administrative support
I.   Roles of participants not clear

To reduce this list to a manageable size, each member was given five votes (approximately half of the total number of items). Each member was allowed to assign a maximum of three votes to any one item.

The problems received the following votes:	
A. ////	F. /////
B. //	G. ///// /////
C. ///	H. //
D. ///// /////	I. ///// ///
E. ///	

The group then decided to focus on problems D, G, and I.

Nominal Group Technique

Nominal group technique is a structured method to prioritize items in a list. This method uses priorities of each group member to discover the overall priorities of the group. Nominal group technique helps you:

- Prioritize a list of ideas.
- Make decisions using inputs from all participants.

How to use it:

Assign a <u>letter</u> to each idea. For example, for seven ideas, you would assign the letters A through G.

List the letters. Have each person in the group write the assigned letters on a piece of paper.

Prioritize the lists. Have each person prioritize their list by writing a number beside each letter. If there are seven ideas, then "1" is written beside the letter corresponding to the most important idea. This is repeated for each number until "7" is written beside the letter corresponding to the least important idea. Each number (1 through 7) is used only once by each group member.

Compute the group total for each letter. The letter with the lowest score is the idea with the highest priority, and the letter with the highest score has the lowest priority.

Nominal Group Technique Example

The following office problems were identified in a brainstorming session:

   A. Ineffective organizational structure
   B. Poor communications outside the office
   C. Lack of training
   D. Poor communications within the office
   E. Unclear mission and objectives
   F. Poor distribution of office mail
   G. Lack of feedback on reports on management

Each group member then wrote the letters A through G on a piece of paper and prioritized each problem from 1 to 7 (highest priority to lowest), using each number only once. The results were summarized as follows:

Problem	Person					Total	Priority
	1	2	3	4	5		
A	6	5	7	5	6	29	6
B	3	2	4	1	3	13	3
C	1	1	2	2	2	8	1 Highest Priority
D	4	4	5	6	4	23	4
E	7	7	6	7	5	32	7 Lowest Priority
F	2	3	1	3	1	10	2
G	5	6	3	4	7	25	5

Pareto Chart

Pareto charts are bar charts used to separate the vital few from the trivial many. The Pareto Principle is a rule-of-thumb, which states that: "20 percent of the problems have 80 percent of the impact." The 20 percent of the problems are the "vital few" and the remaining problems are the "trivial many." A Pareto chart can help:

- Separate the few *major* problems from the many possible problems so you can focus your improvement efforts.
- Arrange data according to priority or importance.
- Determine which problems are most important using data, not perceptions.

How to use it:

Use existing metrics or collect new data on the process. Be sure the units of measure are consistent throughout your data. Select attributes to be charted so that any given occurrence will fall into one **AND ONLY ONE** category. Check sheets are great sources of data for building a Pareto.

Label the chart. Label the units of measure on the left vertical axis and the categories of problems on the horizontal axis.

Plot the data. Order the categories according to their frequency, not their classification. Use a descending order from left to right. Categories that appear infrequently, or in comparatively small numbers, can be grouped together in an "Other" category.

Optional. You can place a line that represents a cumulative total above the bars along with a percentage scale along the right vertical axis.

Points to remember:

- Determine which type of measure is most important ($, #, %, etc.) and clearly mark these units on the chart.
- Order categories from left to right, in descending order, to highlight impact.
- If the "Other" category accounts for more than 25% of the problem, a good rule-of-thumb is to break it down.

Pareto Chart Example:

Billeting Complaints
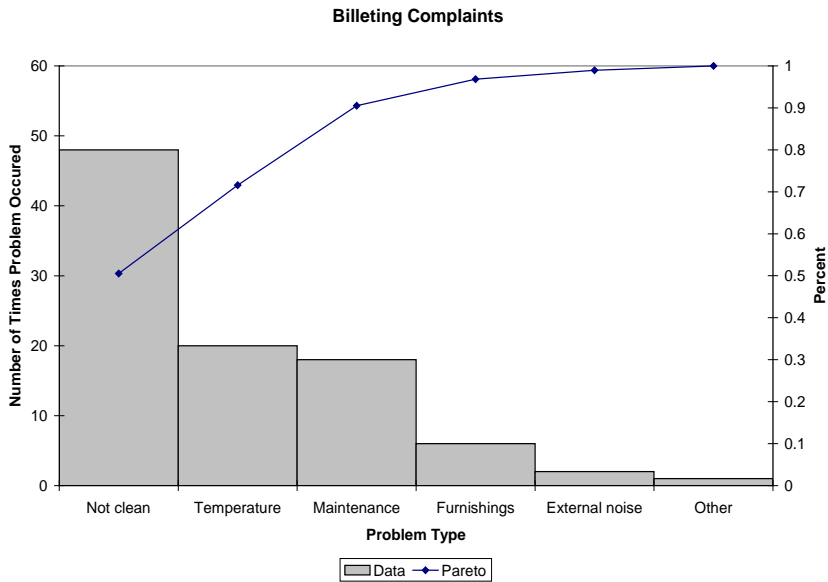
Progressive Analysis. Progressive analysis takes one category from the Pareto chart and breaks it down into its subparts, progressing from the general classifications to the specific. It is used when the category has many subparts to it that might be affecting it. The resulting bar graph is a Pareto chart which can then be broken down even further.

Project Requirements Table

A project requirements table can help prioritize tasks in terms of musts, wants, and nice-to-have items and establish project scope.

How to use it:

Simply list the project customer requirements in the "musts" column and deliverables that the customer wants, but are not requirements, in the "wants" column. Then, list items that would delight the customer in the "nice" column. Customer requirements, as well as time and resource constraints, will help guide project scope.

Below is a sample, completed Project Requirements Table:

Project: Build Storage Facility		
Musts	**Wants**	**Nice**
❑ 5,000 sq. ft. ❑ Secure access ❑ Separate unit storage cages ❑ Heavy-duty shelving ❑ Large garage door ❑ Energy-efficient lighting ❑ Fire equipment	❑ Air conditioning ❑ Garage door opener ❑ Water fountain	❑ Finished interior ❑ Light sensors

Project Responsibility Matrix

A project responsibility matrix can help project managers coordinate the completion of tasks.

How to use it:

List all tasks for the project under the tasks column. If necessary, use additional sheets. Typically, project managers will assign the same letter or number used to identify tasks from a work breakdown structure (WBS) or other planning tool. Then list the project team members or other individuals that will complete or support the completion of each task under the project contributors heading. Consider also those individuals that must be notified prior to task start. To fill out the matrix, assign the appropriate task responsibilities to each person.

The example below depicts typical headings and values.

Project:	Revision Date:			Completion Date:		
Manager:	**Project Contributors:**					
Tasks:						

Responsibility: 1 = Key Role, 2 = Support Role, 3 = Must Notify

Run Chart

Also called a trend chart, a run chart is a graph that shows the changes in a process measure over time. It can help you:

- Recognize patterns of performance in a process.
- Document changes over time.

How to use it:

Construct the chart. Label the vertical axis with the key measurement of the process being measured.

Collect the data. Collect data for an appropriate number of time periods, in accordance with your data collection strategy.
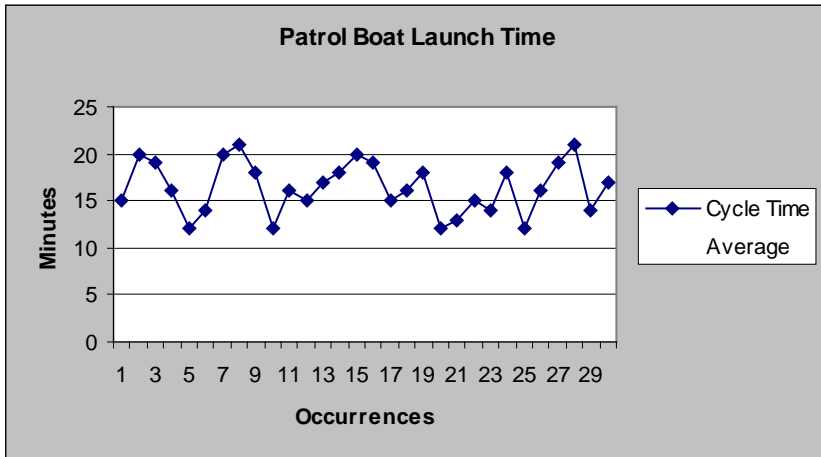
Plot the data. Plot each data point on the chart. Calculate and plot the average. This provides a reference for drawing conclusions about individual data points.

**Interpret the chart.** Use your knowledge of the process.

Patrol Boat Launch Time
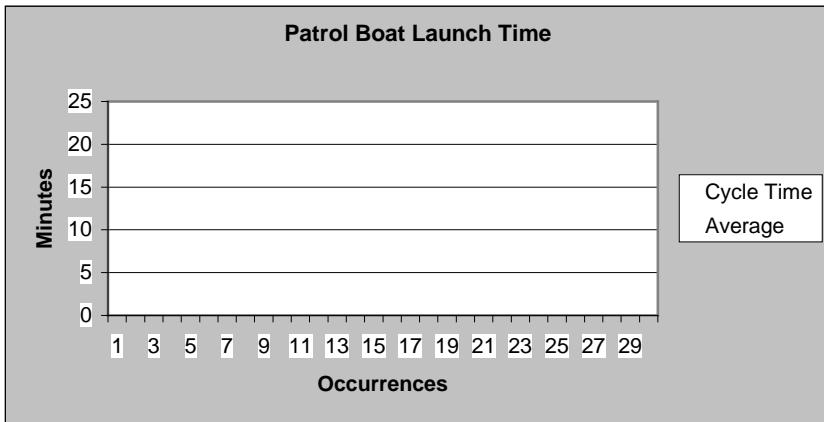
Step 1: Construct the chart. In this case, the unit is looking at its launch time in minutes.

Step 2 (not shown): Collect the data. Data collection is often done on a check sheet, logbook, or spreadsheet.

Patrol Boat Launch Time

Step 3: Plot the data. Each data point is plotted on the chart in the order it was collected (as it occurred in time).

Patrol Boat Launch Time
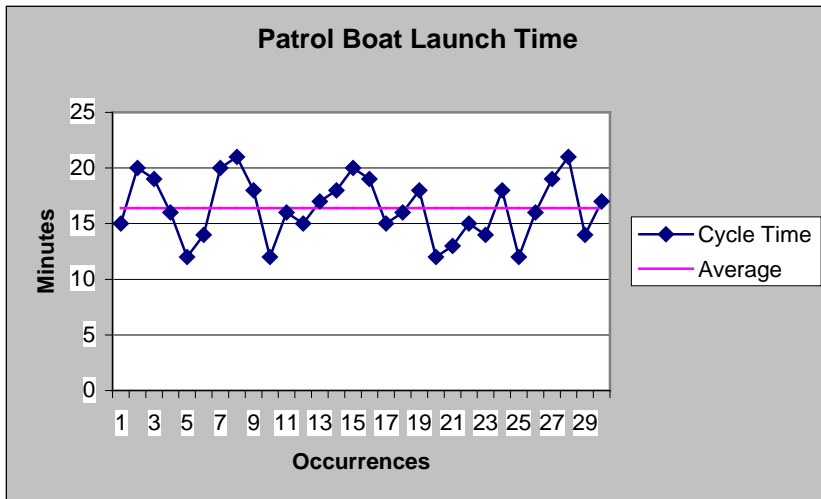
Step 4: Calculate and plot the average. The average is the sum of all the data points divided by the number of points.

Step 5: Interpret the chart. In order to properly interpret your data, there are a few things you must know.

First, how was the data collected? Was it collected specifically for your purpose or as the byproduct of some other process? What emphasis was given to this data collection effort? Was it verified by a second collection method or source? These questions are important for data integrity. The closer your data is to reality, the better the analysis.

Second, you need to know if the process you are measuring is stable. In other words, did the same process generate all of your data? When multiple people accomplish the same objective, they often use different processes. If this is the case, your data will not be a true reflection of a single organizational process and your analysis may be affected as a result. Another example of how a change process can be used to create a data set is initiating a process improvement effort. If, during the data collection, you alter the process (installing new machines or improving existing techniques), your data will need to be divided as shown on the following page.

A stable process will generate different values; this difference is called **variation**. **Common cause variation** is the difference in numbers generated by a stable process. **Special cause variation** generates a value outside of the normal range of numbers and will be discussed later.

If the data integrity is satisfactory and the data-generation process was/is systematic and repeatable, it is time to interpret the chart.

To begin, look for signs that the process has significantly changed. There are three basic ways to do this:

- Six points in a row that steadily increase or decrease.
- Nine points in a row on the same side of the average.
- Significant shifts in levels, cyclical patterns, and bunching of data points.

If any of these can be seen on your chart, explore what happened to your process to cause the change. Positive changes should be documented and institutionalized. Negative changes should be analyzed and their root causes corrected.

Next, identify the range within the data set. Is the difference between the highest and lowest points on the chart acceptable? Even if the chart shows only a few points too high or too low, you may need to improve or redesign the process. If the range is acceptable and the process is stable, there should be no need to change your system.

49
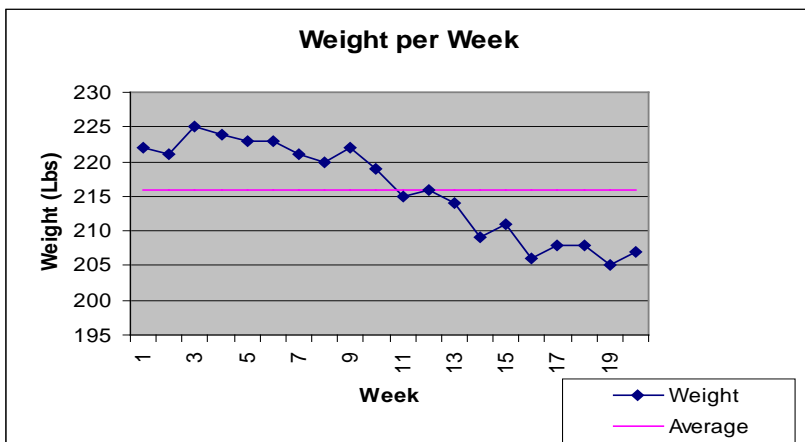
The above chart shows more than nine points above the average line indicating a change in the process. Root cause: In week 11, the individual measured on this chart began training for a marathon (a different process).
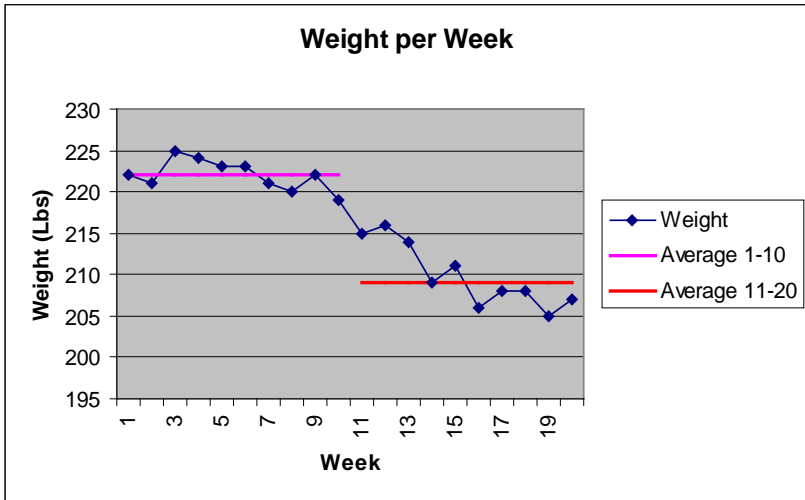
A more descriptive way to display the data might be to separate the stable process from the new process and assign each its own average. You should expect to see the second average drop as the new process stabilizes.

Scatter Diagram

A scatter diagram is a graph that can reveal a possible relationship between two variables. Use it to identify possible causes of problems and to recognize how one important variable might be related to another.

How to use it:

Collect the data in pairs. A data pair consists of two different variables that appear to have a relationship.

Construct the graph. Label the horizontal and vertical axes in ascending order. Ensure that the values on the two axes correspond to the data pairs.

Plot the data. As you plot each point, look for patterns. Circle repeated points. The figure below gives an example.
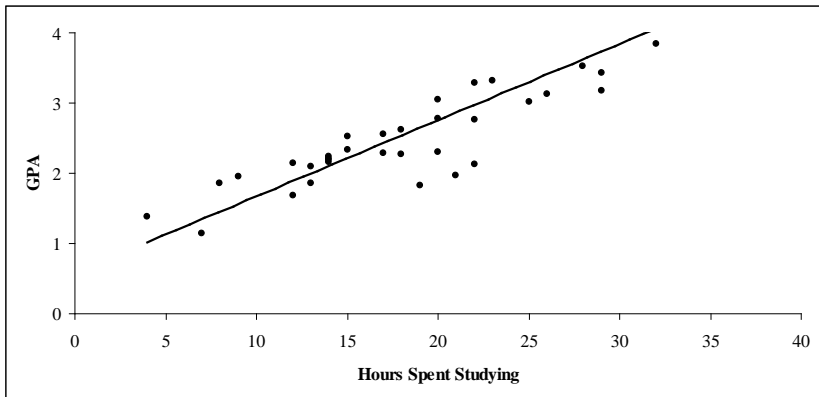
If there appears to be a relationship between two variables, they are said to be correlated. This means that a relationship exists, not that one variable causes the other. Further analysis using advanced statistical techniques can quantify how strong the relationship is between two variables.
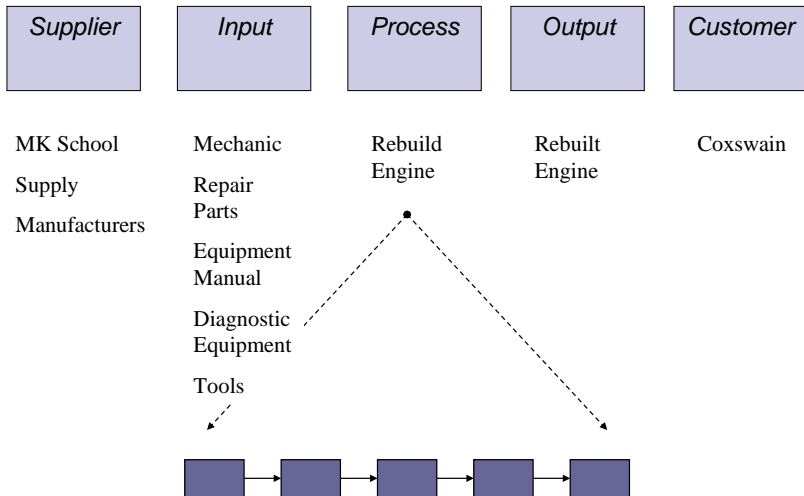
SIPOC

SIPOC is shorthand for Supplier, Input, Process, Output, and Customer. It enables a group to identify customer requirements and factors that affect a given process.

How to use it:

Begin by describing the process you wish to examine in verb-noun format. For example: conduct boarding, fix equipment, or fill prescription. Next, create a high-level flow chart of the process. A good rule-of-thumb is to identify about five to seven major steps. A flow chart can help you visualize how inputs are transformed into outputs. Then list outputs; identify customers, customer segments, or stakeholders that receive each output; list inputs; and identify suppliers that provide each input.

SIPOC

Supplier	Input	Process	Output	Customer
MK School Supply	Mechanic	Rebuild Engine	Rebuilt Engine	Coxswain
Manufacturers	Repair Parts			
	Equipment Manual			
	Diagnostic Equipment			
	Tools			

A SIPOC can help you identify and address sources of variation which affect outputs and, ultimately, the customer. Variation is present in all processes. It comes from the inputs to the process and is also generated within the process itself. When identifying inputs to the process, it helps to consider the "6 Ms"—methods, manpower (personnel), materials, machinery, Mother Nature (environment), and measures—are six key sources of variation.

If, during an analysis of a process, you find that an input is a root cause of the problem, you must work with the associated supplier to correct the problem.

Measures of efficiency and effectiveness can you help monitor process health. See the section on performance measures for more information.

Stakeholder Analysis

Use a stakeholder analysis to identify stakeholders and potential risks during any project that involves change.

| Names	Strongly Against	Moderately Against	Neutral	Moderately Supportive	Strongly Supportive

How to use it:

1. Plot where individuals currently are with regard to desired change (✓ = current).
2. Plot where individuals need to be (X = desired) in order to successfully accomplish desired change—identify gaps between current and desired.
3. Indicate how individuals are linked to each other; draw lines to indicate an influence link using an arrow ($\rightarrow$) to indicate who influences whom.
4. Plan action steps for closing gaps.

SWOT Analysis is a method of performing an environmental scan that is often used as an input to a strategic or project plan. It allows a group to capitalize on their strengths, identify weaknesses, take advantage of opportunities, and identify threats.

SWOT Analysis

Strengths	Weaknesses	Opportunities	Threats
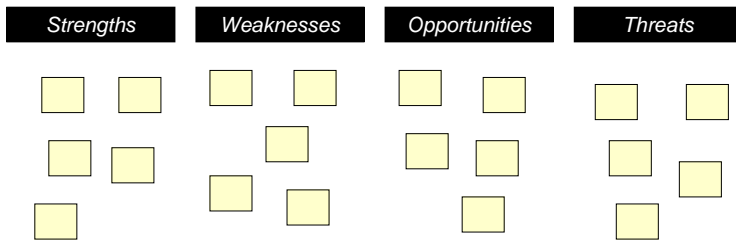
SWOT analyses take both an internal and external view. The strengths and weaknesses categories are looked at from an internal perspective (internal to the group or unit), while the opportunities and threats categories are looked at from an external perspective (external to the group or unit).

How to use it:

Two common methods for conducting a SWOT analysis are silent brainstorming and round-robin.

Silent Brainstorming Method

Silent brainstorming means that there is no discussion until the entire group stops brainstorming. Have each participant write their ideas on 3X5" Post-It® notes using fine-point permanent markers, one idea per Post-It®. Concentrate on one category of the SWOT at a time, and post the notes on a pieces of labeled chart paper as participants generate them. This way, participants can feed off of other ideas. Twenty minutes per category is a good rule-of-thumb for this method. Some of the best ideas will surface after a lull in activity, so avoid rushing the process.

After the group has completed brainstorming, assign several members per category to group and label the items. Then check in with the group regarding the results.

Round-Robin Method

Label four charts: strengths, weaknesses, opportunities, and threats. Split participants into four groups and assign a chart to each group. Have group members write their ideas on 3X5" Post-It® notes using fine-point permanent markers, one idea per Post-It®. Have them post the ideas as they go. Assign a timekeeper and rotate groups so that they are assigned a new chart at previously agreed-upon intervals. Five minutes per category is a good rule-of-thumb for this method. As groups rotate, they must read the ideas generated by previous groups, then add their own ideas. After the entire cycle, assign several members per category to group and label the items. Then check in with the group regarding the results.

Why Technique

Asking, "why?" repeatedly allows you to peel away layer after layer of symptoms to get to the heart of an issue. This technique also helps you see how different causes of a problem may be related.

How to use it:

- Describe the problem in specific terms.
- Ask why it happens.
- If the answer doesn't identify a root cause, ask why again. You have identified the root cause when asking why doesn't yield any more useful information.
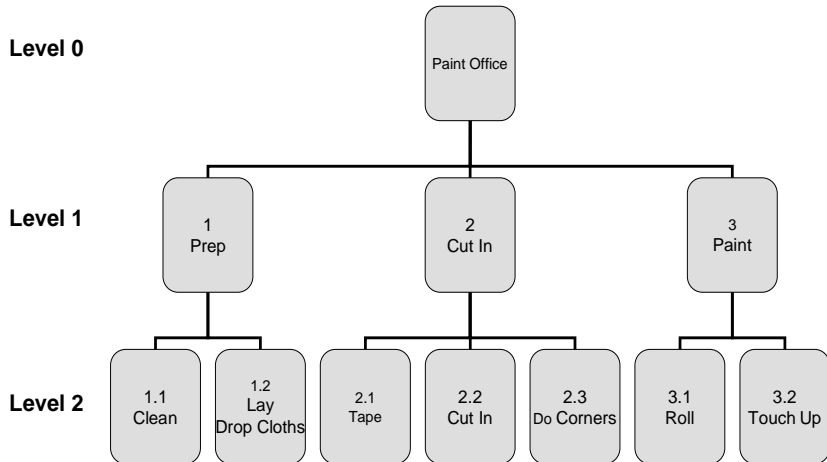
Points to remember:

- Always focus on the process/aspects of a problem, rather than on the personalities involved. Finding scapegoats does not solve problems!
- Answers to each successive "why" may require gathering additional information.
- A problem may have more than one root cause. In this case, the key is to address the causes that have the most impact.

A WBS is used to identify the work to be done and the scope of a project.

Work Breakdown Structure (WBS)

| Level 0 | | | Paint Office | | | | |

```
Level 0                         ┌─────────────┐
                                │ Paint Office│
                                └─────────────┘

Level 1      ┌──────────┐    ┌──────────┐    ┌──────────┐
             │    1     │    │    2     │    │    3     │
             │   Prep   │    │  Cut In  │    │  Paint   │
             └──────────┘    └──────────┘    └──────────┘

Level 2   ┌──────┐ ┌──────────┐ ┌──────┐ ┌──────┐ ┌──────────┐ ┌──────┐ ┌──────────┐
          │ 1.1  │ │   1.2    │ │ 2.1  │ │ 2.2  │ │   2.3    │ │ 3.1  │ │   3.2    │
          │Clean │ │   Lay    │ │ Tape │ │Cut In│ │Do Corners│ │ Roll │ │ Touch Up │
          │      │ │Drop Cloths│ │      │ │      │ │          │ │      │ │          │
          └──────┘ └──────────┘ └──────┘ └──────┘ └──────────┘ └──────┘ └──────────┘
```

How to use it:

Prior to defining the work to be accomplished, gather relevant information regarding customer and stakeholder requirements, as well as available resources. Then, begin to identify the work that needs to be accomplished in appropriate sized chunks called "work packages." This is best accomplished in a small group setting, since different people will have a different perspective on the work that needs to be done. A simple way to accomplish this task is to use 3 X 5" Post-It® notes and chart paper. Arrange the Post-It® notes in a tree fashion.

There are two general approaches to identify the work: top-down and bottom-up. In the top-down approach, begin at Level 0 with the overall project. Then, break work down into categories beginning at Level 1 and down to further levels as appropriate. Typically, smaller projects will not go beyond Level 4. A good rule-of-thumb is to break each work package down so that each does not exceed 80 hours. This is known as the 80-hour rule.

Once the overall work is identified, a common way to formalize the WBS is to put it in outline format. Using a numbering system, work packages can be identified by levels and tasks. For example, tasks at Level 1 of the WBS may be labeled 1, 2, 3, and so on; tasks at Level 2 may be labeled 1.1, 1.2, and so on. Each task can then be assigned appropriate personnel, budget, and a due date.

More complex projects may require the use of specialized scheduling tools such as activity network diagrams or Gantt Charts; other project planning or implementation tools; or project management software.

TABLE OF TOOL USAGE   Frequent • Occasional o

Tool	Generate Ideas	Collect Info	Analyze Info	Make Decisions	Display Info	Plan
Action Planning						•
Affinity Diagram	•		o			
Brainstorming	•					
Cause & Effect			•			
Charter						•
Check Sheet			o			
Consensus Cards				•		
Contingency Diagram						•
Control Charts			•	•	•	
Critical-To-Quality Tree		•				
Customer Rqmts Matrix		•	•			
Decision Matrix				•		
Flowchart			•			
Force-Field Analysis						•
Histogram					•	
Kano Model	•					
Multi-Vote				•		
Nominal Group Technique				•		
Pareto Chart			•		•	•
Project Rqmts Table						•
Proj Responsibility Matrix						•
Run Chart					•	
Scatter Diagram			•	•	•	
SIPOC			•			
Stakeholder Analysis						•
SWOT Analysis						•
Why Technique			•			
Work Brkdown Structure						•

TABLE OF TOOL USAGE (DMAIC)   Frequent ● Occasional o

Tool	Define	Measure	Analyze	Improve	Control
Action Planning	●	o		●	
Affinity Diagram		o			
Brainstorming			o	●	
Cause & Effect			●		
Charter	●				
Check Sheet		●			
Contingency Diagram				o	
Control Charts		●	●		●
Critical-To-Quality Tree	●	●			
Customer Rqmts Matrix	●				
Flowchart	●	●	●	●	
Force-Field Analysis				o	
Histogram		●	o		
Kano Model	●				
Multi-Vote				●	
Nominal Group Technique				●	
Pareto Chart		●	●		
Project Rqmts Table	o			●	
Proj Responsibility Matrix	o			●	
Run Chart		●	o		
Scatter Diagram		●	o		
SIPOC	●				
Stakeholder Analysis	●				
SWOT Analysis	●				
Why Technique			●		
Work Brkdown Structure	●			●	

QUICK TOOLS REFERENCE GUIDE