UNION
QUALITY
NETWORK

Taking
Quality
to the
next level

Welcome to the UQN's *QStP Tool Kit for Quality*!

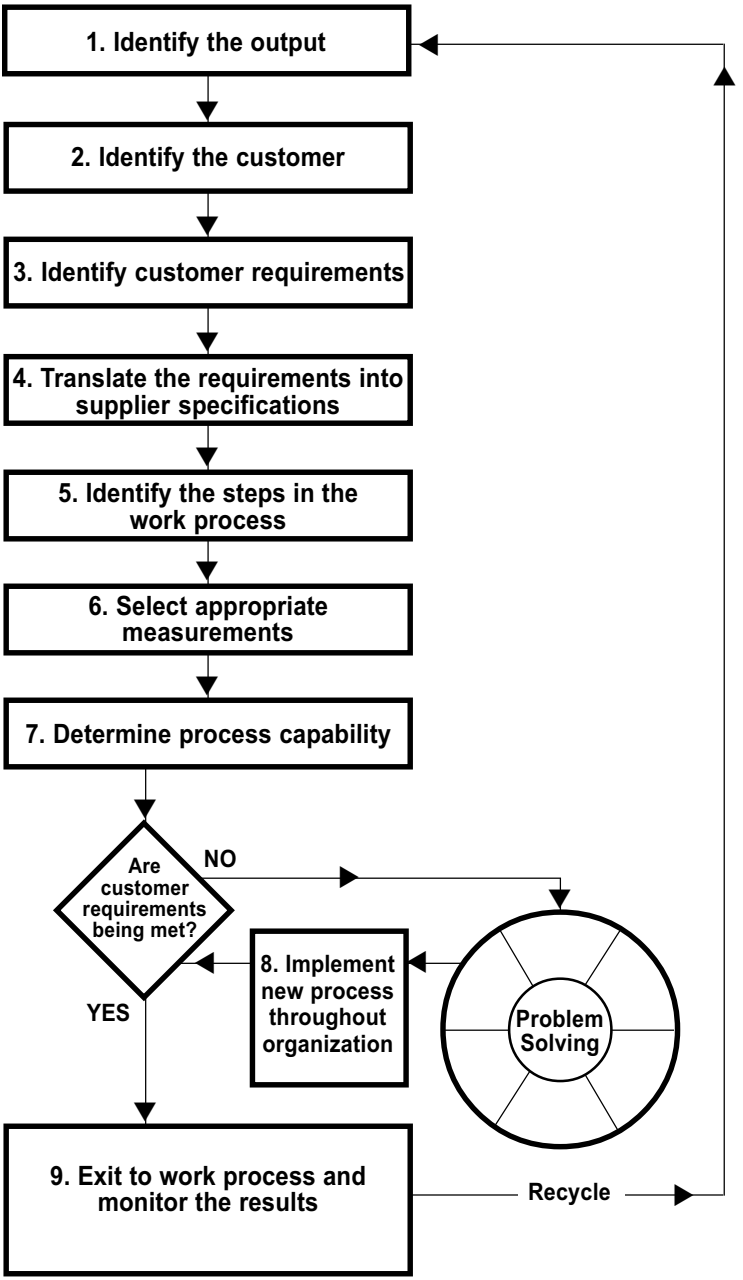
Inside are detailed descriptions of the most often used tools you need to generate ideas, collect information, analyze and display data, reach consensus, and plan actions. It's a small book, but it can make a big difference in what you accomplish each and every day.

These tools, by the way, represent the very best practices. They're routinely used in all world-class organizations because they work, and they're easy to use! The next time you're working to generate ideas, try brainstorming. If you're analyzing a process, create a flow chart. When you're trying to pinpoint a root cause, use a Pareto chart. You'll be amazed by the power of these simple tools!

Best of all, *you* can use these tools *starting now*. If you're in a formal process-improvement team or an informal work group, you'll have all sorts of opportunities. If you participate in meetings, the tools will help you reach new levels of meeting effectiveness. You can even use them on your own. If you want the best results, then use the best practices.

Please keep your *QStP Tool Kit for Quality* in a handy location, and make it a routine reference source. You'll find that great things really do come in small packages!

QStP CONTINUOUS IMPROVEMENT PROCESS



QStP CONTINUOUS IMPROVEMENT PROCESS

1. Identify an output
Write a statement describing an output for the process. Outputs are best described as both a noun and verb.

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2. Identify the customer(s) for this output
Who are the customers of this output? Remember that there are internal and external customers.

↓

3. Identify the customers' requirements for this output
Think about the customers. When it comes to this particular output, what are their needs and expectations? (Ideally, we should go directly to the customer for this information!)

↓

4. Translate the requirements into supplier specifications
Turn the requirements into a list of specific, measurable specifications. (Again, if there's any confusion here, the best thing to do is to ask the customer.)

↓

5. Identify the steps in the work process
List the main steps in the process and/or draw a simple flow chart to illustrate how the steps fit together. Remember that a process should have a clear starting point and ending point.

↓

6. Select appropriate measurements
If you were going to determine whether the output from this process is meeting customer's needs and expectations, what measuring sticks would you use? Concentrate on the vital few measures that provide information about the quality of your output.

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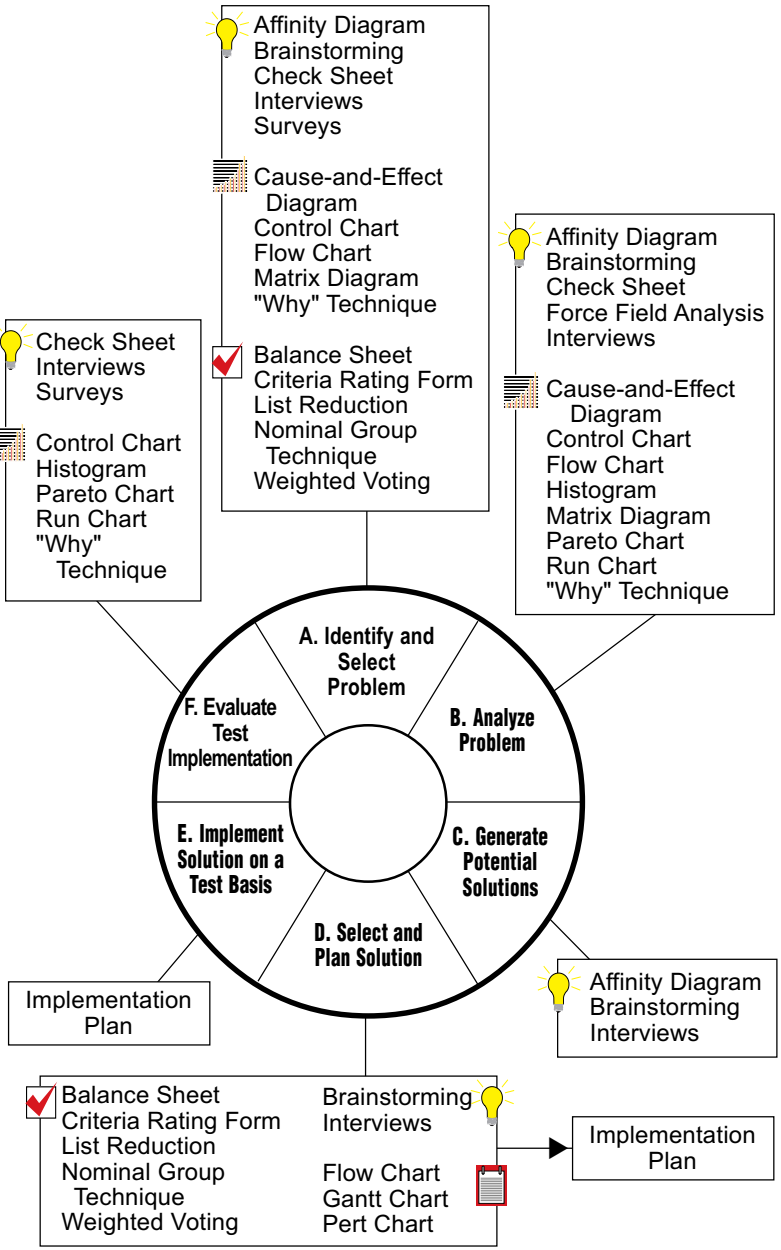
7. Determine process capability
Are customer requirements being met? Use the measurements from Step 6 to answer the question. If not, the next step is to move on to problem solving.

QStP PROBLEM SOLVING



AFFINITY DIAGRAM

If you ever find yourself wrestling with too much information, unable to organize it in an effective way, the affinity diagram is for you. This powerful tool pulls together an enormous volume of ideas, leaving you with well-sorted groupings that give the information clear meaning.

Putting it to work

1. Begin by writing the issue to be considered. Keep it neutral and concise, and write it on a flip chart so all can see. For example: "What do our customers want from us?" Another example: "What implementation issues do we need to address as a steering committee?" Discussion and editing will likely be necessary as the team works to decide on the exact phrasing. Make sure there is consensus support for the final version.
2. Spend the next 15 or so minutes brainstorming ideas in response to the phrase. Have one person record the statements on a flip chart – while a second person uses a thick marker to write each statement on a separate note card or Post-It Note. (Post-It Notes work best, especially for displaying the finished product on a wall or flip chart. However, make sure they're big enough!) These responses should be concise (no more than seven words), yet they should be thorough and understandable. Consider the issue: "What do our customers want from us?" Vague responses include "quality" and "service." A richer response would be: "Answer call-in questions within five minutes." Another brief yet to-the-point response: "Receive all the necessary info by mail."
3. Continue generating responses while following all the guidelines of brainstorming. All ideas are accepted without criticism and without editing by the recorder. The more ideas, the better.
4. After all the ideas have been put forward, take the cards (or Post-It Notes) and spread them out on a large table. At this point, there's no need to organize them. In fact, it's better if they are mixed up in a completely random fashion. See exhibit A.
5. Now it's time to sort. Have the team members

locate and place side by side two cards that are connected in some way – perhaps they deal with the same subtopic, or they touch on activities done by the same group of people, or they have something else in common. This matching process continues, with people building groups of related cards, until the random bunch of ideas has been transformed into 5-10 groupings. If one card seems completely unrelated to all the other cards, no problem; simply let it stand alone as its own grouping. See exhibit B. (For an interesting twist to this step, have team members do their sorting in silence. If one person wants to move a card from one grouping to another, let it happen. Consensus will eventually emerge.)

6. Now that the cards have been sorted, look through each grouping for the one card that conveys the main idea of that grouping and ties all the various ideas together. This becomes the "header" card and is placed at the top, while the other cards are positioned vertically beneath it. If a grouping doesn't seem to include an all-encompassing header card, create one and put it at the top. See exhibit C.

7. Do one last sort. Looking at the header cards, move the groupings so that related ones are next to each other on the table. If you're working with cards, tape them in sorted order on a flip-chart sheet (or, more likely, on several!). If you've opted for Post-It Notes, all you need to do is press them on. Finish up by drawing a box around the related groupings, and create a "superheader" for each of these. You now have a detailed analysis of the issue. It's clearly presented and ready to share.

Exhibit A

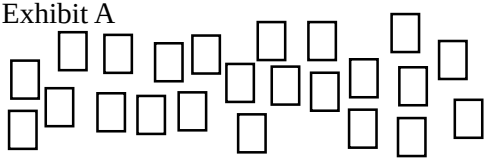


Exhibit B

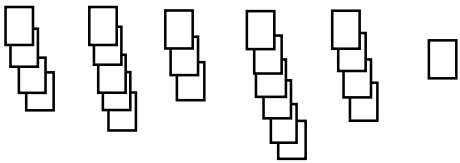


Exhibit C

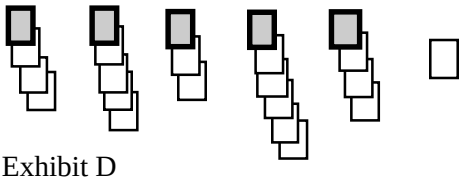
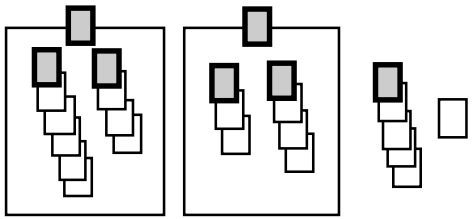


Exhibit D



BALANCE SHEET

Balance sheets allow a group to identify and review the pros and cons of various options. Like the other tools for reaching consensus, balance sheets won't make decisions. They will, however, organize the information and facilitate discussion among group members.

Putting it to work

Using a flip chart or marking board, set up a large grid consisting of two columns and a row for each of the options being discussed. Label the columns + and - (or "pros" and "cons"). The team then "fills in" each cell of the grid, brainstorming and reaching consensus on positive and negative aspects for each option.

Example

The balance sheet shown here was used to identify the pros and cons of three methods of QStP Training.

METHOD	PROS	CONS
Classroom	Highly interactive Synergy from others/dialogue with others Immediate in-class feedback from instructor and participants Immediate answers to questions in class	Expensive Rigid, not flexible Work at the pace of the instructor and class Could be a boring instructor Inflexible time - must go when offered
On-Line (E-learn)	Time flexibility Immediate electronic feedback Can be done at home or anywhere Go at own pace Could be inexpensive for the participant	Could be expensive Might be forced to do at home No immediate feedback from instructor No dialogue or exchange or ideas
Book/ Independent Learning	Time flexibility Go at own pace Do anywhere Inexpensive for the learner	No dialogue or exchange of ideas may never finish May be asked to do on own time Some people are not book learners no mechanism for instructor feedback

BRAINSTORMING

Brainstorming is a powerful way to generate input. Working in a team setting, people express their ideas the moment they think of them. Brainstorming is an informal process in which:

- No one evaluates the ideas as they're announced.
- Wild ideas are encouraged.
- People build on the ideas of others.
- Everyone strives for quantity. The more ideas, the better!

Putting it to work

The team leader (or facilitator) presents the topic for which ideas are sought. The wording should encourage specific, tangible ideas — not abstract or vague thoughts. Make sure everyone in the team understands the topic that's the focus of the brainstorming, as well as the process to be followed.

There are three methods of brainstorming. The most familiar is **freewheeling**, in which:

- Group members call out their ideas spontaneously.
- The scribe records the ideas as they are suggested.

In **round-robin** brainstorming:

- The leader or scribe asks each member, in turn, for an idea.
- Members may pass on any round.
- The session continues until all members have passed during the round.
- Ideas are recorded as in free-wheeling brainstorming.

The **slip method** differs markedly from the other two approaches:

- The leader asks members to write down their ideas on small slips of paper or index cards.
- The ideas are then collected and organized.

CAUSE-AND-EFFECT DIAGRAM

The cause-and-effect diagram offers a systematic way to pinpoint the various factors that may be causing a problem. It prompts people to ask: "Why is this occurring?" As the diagram is developed, more and more potential causes come to light.

Some people call this tool the "fishbone diagram" because it takes the shape of a fish as more causes are brainstormed. The effect (problem) is the "head of the fish." Leading from this is the "backbone" and connected to this are the "main bones," which represent major categories of causes. Commonly used categories include people, policies, procedures, equipment, materials and environment. These categories are only suggestions; you may use any major category the team deems appropriate.

Putting it to work

Follow these three steps when creating a cause-and-effect diagram:

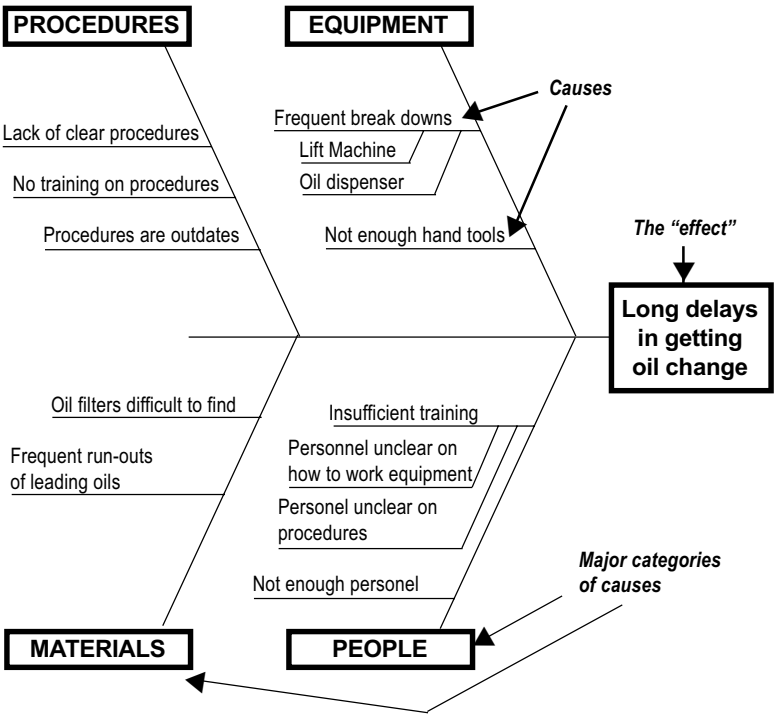
1. Decide on the effect (problem) to be analyzed, being sure it's specific, well-understood and agreed to by everyone. Write it in a box on the right side of the flip chart or marking board; this is the "head of the fish."
2. Next, draw a horizontal line from the head across the paper, with several "major bones" drawn on a slant. At the end of each, write one of the major categories that contribute to the effect.
3. Brainstorm specific causes. Attach each specific cause to an appropriate major category. Whenever possible, break down the specific cause into subcauses by using the "why" technique. Keep asking "Why is this occurring?"

Here are some additional tips:

- If in doubt about possible causes, check your ideas with data. Look for causes that appear repeatedly. This will have the added benefit of helping the team reach consensus.
- In most cases, it's not so important where the specific cause is placed on the diagram. The important point is that it's identified.
- The cause-and-effect diagram can be useful when displayed publicly and people are invited to contribute. Think of this as a large-scale brainstorming effort.
- When creating the diagram, try to use as few words as possible. This will require team members to focus their ideas.

Example

As you can see, the diagram does indeed have the shape of a fish. The effect is on the right, and the causes form the "bones" of the fish. Note the four main categories of causes.



CHECK SHEET

The check sheet is an easy-to-use tool for collecting data in a consistent, structured way. The most common check sheets are arranged in columns or in matrices, with the categories listed on the left side and space on the right to make tally marks. The collected data can be analyzed with other tools such as control charts, Pareto charts and histograms.

All sorts of data can be tracked using check sheets, including:

- Number of times something happens
- Length of time it takes to get something done
- Cost of a repeated operation over a period of time
- Frequency of occurrence — by unit, program, level, work area, etc.
- Impact of an action over a period of time

Check sheets are highly recommended when data are to be collected or organized to establish a base from which to measure improvement. They are also helpful when different people will be collecting or using the data, because the check sheet format involves a high level of standardization.

Putting it to work

1. Decide what you need to know. In other words, what data do you need to track?
2. Determine whether the information exists or if it needs to be collected.
3. Discuss and decide on the most reliable way to collect the information you need. As you do this, you'll be creating the appropriate matrix headings.
4. Decide who will collect the information, for how long, and from what sources.
5. Finalize the check sheet format
6. Conduct a pilot test of the check sheet to see if it meets everyone's data-gathering needs.
7. Make any revisions to the check sheet, and if necessary, conduct another pilot test. Otherwise, begin using it on a full-scale basis.

Important Tips

Information on a check sheet is usually collected in categories: by work unit code, branch, date, shift, subprocess, and so on. When creating a check sheet, make sure categories are logical and easily understood. This is important not only for the people who will be interpreting the gathered data, but also for those who use the check sheet to collect the data. They should not have to make difficult judgments about when and where to enter a check mark on the form.

- Have clear instructions on what's to be collected and how.
- Keep it simple! Use clear, easily understood language. Be sure that the people who are using the check sheet to collect data know what you want and can ask for clarification if needed.
- When asking a group to use a check sheet, give them the bigger picture. Let them know why this is important. Later in the process, keep them informed on what you do with the data.
- Remember, you can also make check sheets from data you already have. Sometimes it's not even necessary to collect new data.
- Make sure that "bad news" is okay. In other words, there shouldn't be any pressure for people not to record "bad" information – or to skew the information as it comes in. What we're looking for here are just the facts.
- The check sheet can easily be turned into a Pareto chart. Depending on the type of check sheet you construct, it may also be able to be turned into a run chart and/or a control chart.

Example

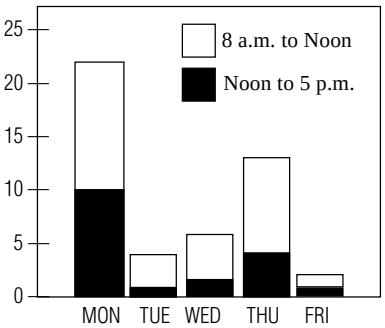
Below is a check sheet prepared by a telephone coverage team. Their objective is to track the number of callers who had to wait "on hold" when calling a help line.

Number of callers "on hold" when calling the help line:

	MON	TUE	WED	THU	FRI
8 a.m. to Noon	𝍸 II 𝍸	IIII	III	IIII IIII	II
Noon to 5 p.m.	𝍸 𝍸	II	I	IIII	I
TOTALS	22	6	4	12	3

For visual impact, the data from a check sheet can be placed into a bar chart.

Number of callers "on hold" when calling the help line:



CONTROL CHART

A control chart is a run chart (line graph) that tracks the performance of a process over time through the use of statistically determined upper and lower control limits.

Control charts are based on four concepts:

- All processes fluctuate over time;
- Individual points are unpredictable;
- A stable process fluctuates randumly and within predicatble boundaries; and
- An unstable process flutuates non-randomly and unpredictably.

Control charts are used to show the variation of a process, distinguishing between common causes and special causes of variation. Common causes of variation are those data points that fall between the control limits which mark the statistically normal distribution. Special causes are when data points fall outside of the control limits. A process is said to be stable or "in control" when only common cause variation exists. Likewise, a process is unstable or "out of control" when special causes of variation exist.

The table below presents the most commonly used types of control charts. They have different uses based on the kind of data that is used. Most teams in state government measure items like time to process an item or the number of items produced in a given time period. Therefore, the first two charts listed in the table below are most commonly used.

With a control chart, you can:

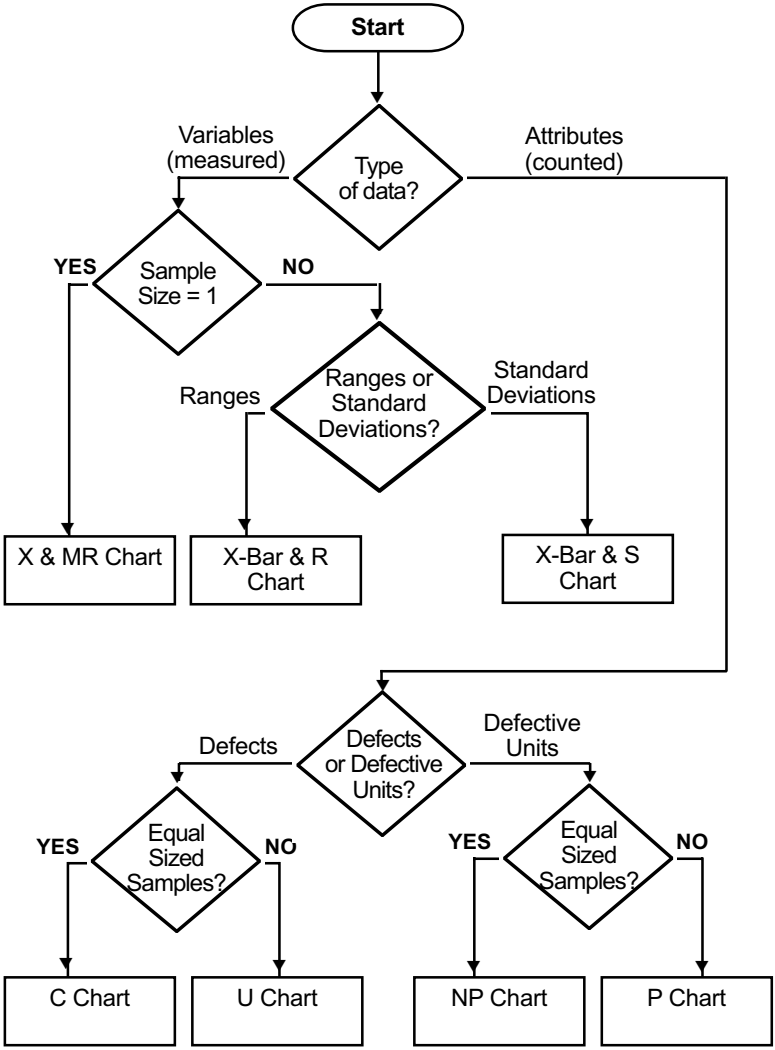
- Find out a system's capacity so that normal variations are not misinterpreted as significant, thus causing tampering with results.
- Identify "special causes" of variation (those that fall outside of the control limits) so they can be eliminated.
- Know when changes have actually improved the system.
- Monitor the system after improvments have been made.

Putting it to work

1. Select the control chart type(s) appropriate to your data and process characteristics.
2. Decide what you want to measure and record measurement data on the vertical axis.
3. Divide the data into subgroups or measurement intervals according to date, time, lot, etc. Plot the subgroups on the horizontal axis.

Choosing the right chart

The type of control chart you use depends on the type of data you collect. This figure can help you to determine what type of control chart to use.



Types of Control Charts and How They're Used

Category	Chart Type	Statistical Quantity	Application
Variables Data *Measured Values*	*X- R* chart (X bar R)	mean value and range of sub-groups	Charts dimensions i.e. weight, time, strength, and other measurable quantities. Used with high volumes of data grouped into sub-groups. Charts the average of the actual data (x) and the average of the moving range (Rm) between data points
	X, MR chart (individual moving range)	individual measured values	Used when data is measured in individual values rather than in sample sets. Used in service industries to measure things like accounts receivable, customer service ratings, turn around time. etc. Charts the individual average and moving range.
Attributes Data *Counted (numerical) values* *go/nogo* *yes/no* *ok/not ok*	*pn* chart	number of defective units	Charts the number of defective units in sample of fixed size.
	p chart	percent defective	Charts the number of defective units in samples of varying size (fraction defective).
	c chart	number of defects	Charts the number of flaws appearing in a product of fixed size or previously defined unit over a certain period of time (e.g., the number of cracks in a metal plate or glass product).
	u chart	number of defects per unit area	Charts the number of flaws that appear on a product of varying size over a period of time (e.g., bruises in wire material and irregularities in fabrics).

4. Calculate the average value and control limits.
5. Mark these points on the vertical axis and draw horizontal lines from their respective values.
6. Complete the chart by plotting the observations.

Example

The table on the following page contains sample data from the library case study. The data point x equals the number of days to fulfill a request for a book.

1. Decide what type of control chart is most appropriate. The X, MR chart will be used here in this example.
2. Record the data. Usually 20-25 data points are needed to calculate the average and control limits.
3. Calculate the moving range (MR column) which is the difference between the current reading and the previous one. Simply subtract each value from the previous value. The first data point will not have a corresponding range number. The moving range (MR) is the absolute value of the difference which is always a positive number or zero.
4. Calculate the average (also known as the "mean") for the x and moving range (MR) columns using all data points. Here's how the calculation looks:

   Average of x = X = (30 + 27 + 26 + ... +15) / 30 = 15.4

   Average moving range MR = (3 + 1 + 6 + ... +9) / 29 = 4.31

5. Calculate the control limits and construct two graphs: x control chart and MR control chart. Note: Each type of control chart has a unique formula and uses a constant which is taken from a table available in reference materials.

X Chart: Upper control limit = UCL = X + (2.66) (MR)

= 15.4 + (2.66) (4.31)

= 26.9

Lower control limit = LCL = X - (2.66) (MR)

= 15.4 - (2.66) (4.31)

= 3.9

EXAMPLE

No.	x = number of days	MR
1	30	—
2	27	3
3	26	1
4	20	6
5	24	4
6	18	6
7	19	1
8	16	3
9	18	2
10	14	4
11	20	6
12	11	9
13	14	3
14	17	3
15	12	5
16	9	3
17	15	6
18	16	1
19	13	3
20	10	3
21	17	7
22	8	9
23	12	4
24	17	5
25	10	7
26	13	3
27	7	6
28	8	1
29	6	2
30	15	9
Sum	462	125
Ave.	15.4	4.31

Note: 2.66 is a constant. It is always used with this chart.

MR Chart: UCL = 3.27 (MR)

= 3.27 (4.31)

= 14.1

LCL is always zero

Note: 3.27 is a constant to be used always in this chart.

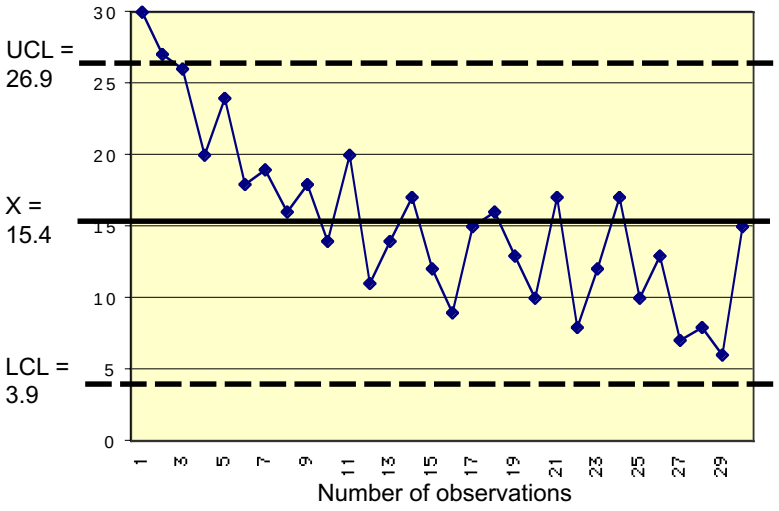
6. Interpret the charts (See the following page)

- First, check to see if the process is stable or "in control" – in other words, whether all of the data points are inside the control limits. If there are data points outside the limits, this "special cause" should be investigated and fixed. Everything else is normal variation.
- Second, look for a continuous sequence of 6 or more points that exists on either side of the X line. This suggests a trend to investigate.
- Third, look for trends with a steady gradual rise or fall in the positions of the point. Seven or more consecutive points reveal a strong trend.
- Fourth, identify any non-random or cyclical patterns.

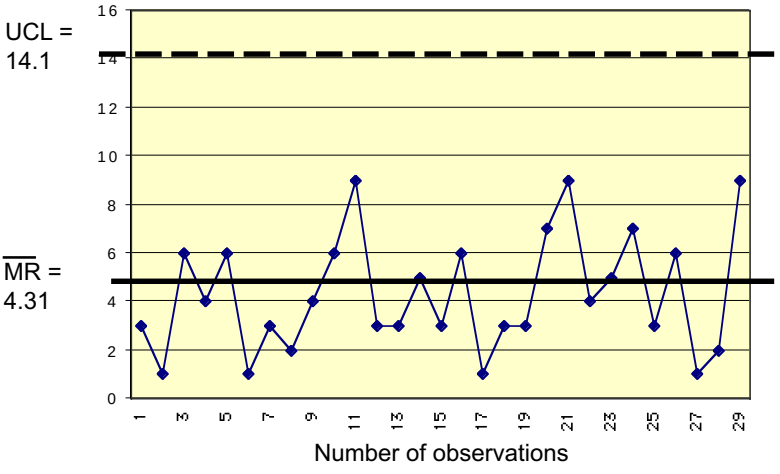
For the example X Chart, we can see that the process is out of control (the first two data points are outside of the control limits). We also see that the average line is shifted to the high side (because the first nine points are above the average). There's a general downward trend, which shows that the process is in transition and has not stabilized yet. You might want to construct a new chart with each new week's worth of data using the most current 30 data points until there is minimal shift in the average between two charts.

The MR Chart shows that the MR is within control limits with no wild fluctuations or patterns which could indicate that the process is moving into control. The MR Chart, when used, is always used in conjunction with the X Chart. (Note: The MR Chart is not always used.)

X Chart



MR Chart



CRITERIA RATING FORM

If you've ever made a major purchase, such as a car or a house, you've probably used a criteria rating form. Well, maybe you didn't create the actual form, but you most likely went through the exercise in your mind. When buying a vehicle, for example, nearly everyone considers such criteria as cost, mileage, trunk space and safety record.

If you listed these on a sheet of paper and rated (say, on a scale of 1 to 5) the three options you were considering on each of the factors, you'd be constructing a criteria rating form. Adding the scores for each vehicle gives you a relative rating of the vehicles under consideration. (See important note on the next page regarding adding up the numbers for each option.) Here's how it would look:

Criteria can be treated equally, or they can be weighted relative to each other. In the example on the next page, weights have been added to each criteria. They indicate that the vehicle's safety record is three times as important as its costs and gas mileage. And trunk space is twice as important as cost and mileage. Each scale rating is then multiplied by its respective weight.

Putting it to work

Follow these steps when creating a criteria rating form:

1. Decide what factors or criteria are to be considered. Normally, three to six criteria will be sufficient. However, it's up to the team to define the criteria and decide the optimal number. Having too many criteria will seriously complicate the exercise — without adding much value.
2. Reach agreement on their definitions.
3. Agree on the scale to be used (1 - 3, 1 - 5, or something else) to rate the options. Determine what (if any) weights should be assigned.

4. Discuss each "cell" on the form to arrive at a consensus rating. It's best to look at all the items being considered and to rate them on a particular criterion at the same time. For example below, the degree to which the solution effectively closes the gap between the "as is" and the "desired state." The group may determine that solution "C" would be the most effective. Assigning it the highest value on this criterion then makes it easier to assign ratings to the other options, relative to this particular solution.

Note: When using the scales, remember that a higher scale number always indicates a better rating. This can be a bit confusing with a criterion like cost. In this case, a higher number (say 5) represents a lower cost. In contrast, if the cost of the option was very high, the scale rating would be very low.

	OPTIONS		
CRITERIA	VAN	SPORTS CAR	MOTORCYCLE
Trunk Space	5	1	1
Mileage	3	4	5
Cost	3	3	4
Safety Record	5	3	2
TOTAL	16	11	12

Rating Scale:
5 = Very Good
4 = Good
3 = Fair
2 = Bad
1 = Very Bad

		OPTIONS		
CRITERIA	WEIGHT	VAN	SPORTS CAR	MOTORCYCLE
Trunk Space	2	5	1	1
Mileage	1	3	4	5
Cost	1	3	3	4
Safety Record	3	5	3	2
TOTAL		16	11	12

NOTE: Some people prefer not to total the numbers for each option. This way, they guard against the risk that the criteria rating form will become just another mechanism for win-or-lose voting. This tool is not the decision-maker.

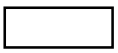
FLOW CHART

Flow charts are step-by-step schematic pictures used to describe a process being studied, to develop an improved or entirely new process, or to plan the implementation of an improvement. As outlines of a sequence of actions, they provide team members with common reference points and a standard language to use when talking about a process. Flow charts provide excellent documentation of a process and can be a useful tool for examining how various steps in a process relate to each other. Flow charting uses easily recognized symbols to represent the type of process performed. By studying these charts, you often can uncover sources of delays, bottlenecks, rework and other pitfalls. Flow charts can be applied to anything from the travels of an invoice or a flow of materials, to the steps in issuing a license or delivering a service.

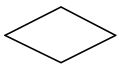
Putting it to work

In creating a flow chart, follow these steps:

1. Decide where the process begins and ends. These become the "begin" point and "end" point of the flow chart.
2. Brainstorm the main activities and decisions in the process. Write these on a flip pad, marking board or somewhere else so the information is visible to everyone in the team. You can even write them on Post-It notes, which makes it convenient when you get to the next step.
3. Arrange the activities and decision points in the order in which they occur. If there's a lengthy list on the flip pad, this step can be simplified by writing a number in front of each activity and decision — 1 for first, 2 for second and so forth.
4. Now it's time to translate your written step-by-step description into a flow chart. Draw the chart using the following common symbols.



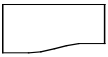
A rectangle designates an activity. Write a brief description of the activity directly in this box.



A diamond indicates a decision point from which the process branches into two or more paths. The path taken depends on the answer to the question that appears within the diamond. Each path is labeled to correspond to an answer to the question.

The terminal symbol identifies the beginning or end of a process, according to the work within the terminal. "Start" or "begin" are used to designate the

starting point of process flow; "stop" or "end" are used to designate the end of process flow.



The document symbol represents a document pertinent to the process.

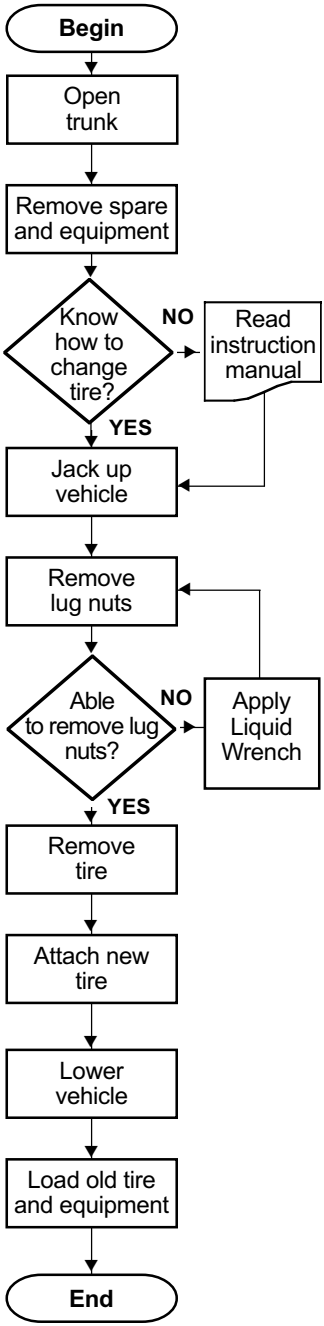
The flow line represents a process path connecting the various process elements: activities, decisions and so on. The arrowhead on the flow line indicates the direction of process flow.

5. Analyze the flowchart for such items as:

- Time-per-event (reducing cycle time)
- Process repeats (preventing rework)
- Duplication of effort (identifying and eliminating duplicated tasks)
- Unnecessary tasks (eliminating tasks that are in the process for no apparent reason)
- Value-added versus non-value-added tasks

Important Tip

When developing the initial flow chart, avoid excessive detail. Otherwise, the team is likely to get confused and frustrated. Early on, keep the flow chart simple — then add detail as necessary to understand the process.



FORCE FIELD ANALYSIS

Force field analysis identifies two sets of forces: those that help you close the gap between where you are now and where you want to be (driving forces), and those that hinder you (restraining forces).

Putting it to work

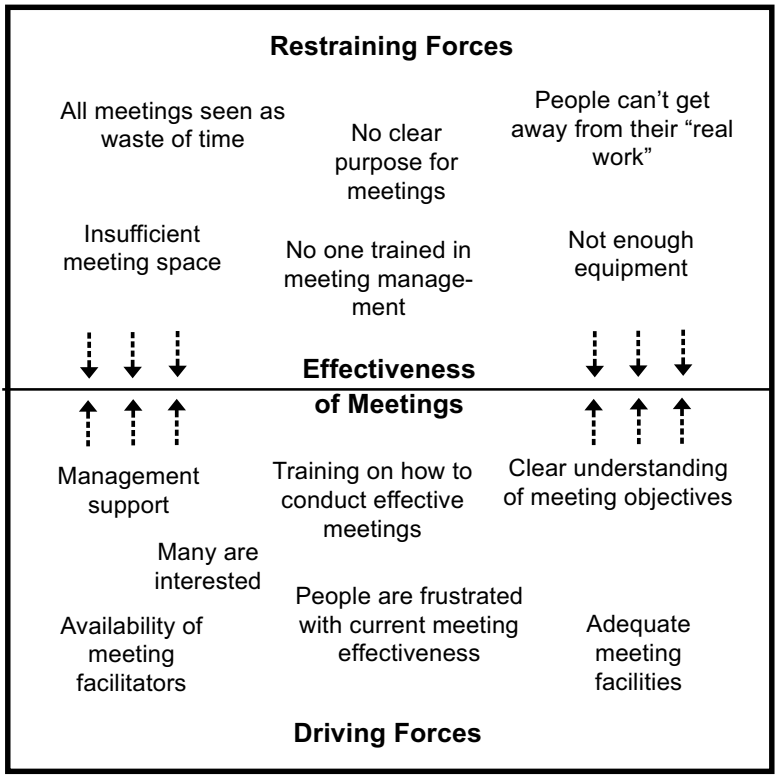
1. Begin by drawing a horizontal line through the middle of a flip chart. This line represents the current level. For clarity, it's best to write down exactly what "current level" we're talking about – as shown in the example on the next page. Also, label the top of the chart "restraining forces" – these are keeping the level from moving higher. Label the bottom "driving forces" – these are pushing up the level.

2. Start with the top half of the sheet. Brainstorm all the different restraining forces that are holding or pushing down the current level. Write all ideas above the horizontal line. Next, use brainstorming to identify all the positive driving forces. Write these below the line to show that they're pushing up the current level. As a last step, you may be able to combine related items; other items may need additional explanation or clarification.

3. Evaluate each factor and assess its relative impact. Use this information to develop specific actions for reducing or eliminating the restraining forces (top half) *and* increasing or adding to the driving forces (bottom half).

Use force field analysis to analyze the current level of QStP implementation in your department (or division, site, work unit, etc.).

Example
To improve the effectiveness of meetings, we'd want to use the driving forces – or add new ones – while decreasing, overcoming or eliminating the restraining forces shown above the horizontal line.



GANTT CHART

The Gantt chart helps to organize a team's plan for implementing its proposed solution. It documents what is to be accomplished, by whom and when. The chart also allows a group to document the assumptions underlying their plan. For example, if it's based on installation of equipment by May 15, that assumption can be noted. The group can develop contingency plans in case the deadline slips.

Putting it to work

What occurs before the chart itself is created is crucial to the effectiveness of this tool. Here are the steps:

1. Brainstorm all the tasks that need to be carried out as part of implementation.
2. Assign responsibility for each task to a team member and/or to people outside the team.
3. Decide how long each task will take, when it can be started and when it's to be completed.
4. Enter this information on the chart, sequencing and overlapping the various steps as appropriate.
5. Document the assumptions on which the plan is based and the contingency plans to implement if those assumptions are not valid.

Example

The Gantt chart below shows part of one team's test implementation. Notice the sheer volume of information you can easily absorb simply by looking at this chart. Consider its value as a tracking tool once implementation is under way.

Schedule		**Week Number:**								
Task	Assigned to	1	2	3	4	5	6	7	8	9
Submit draft for review	Team Leader									
Review draft	Review Comm									
Submit comments	Review Comm									
Revise manual based on feedback	Team									
Create camera-ready materials	Team Leader									
Print 100 copies of manual	Print Shop									
Circulate 100 copies to employees	Team Leader									

HISTOGRAM

A histogram is a specialized type of bar chart that shows the distribution of measurement data. It is a snapshot of a data set. A histogram shows the frequency of occurrence and basic information about the data set, such as central tendency (mean, median, and mode). It reveals the amount of variation occurring in the system. A team uses the histogram to assess the current situation and to study results. The histogram's shape and statistical information help the team know how to improve the system.

Putting It to Work

1. Gather and tabulate data on a process, product, or procedure. This could be time, size, frequency of occurrences (such as error rate), number of days to complete a cycle, and so on.
2. Determine the number of classes by counting the number of data points in the data set. Use the following table to select the number of classes.

# of data points	# of classes
under 50	5-7
50-100	6-10
100-250	7-12
0ver 250	10-20

3. Determine the class width and boundaries by dividing the range of the data set by the number of classes. The range is found by subtracting the smallest value in the data set from the largest.
4. Record the data by creating a check sheet listing the classes along the left side with space to the right to make tally marks. To record the data, make a tally mark beside the class in which each data point falls.
5. Draw the histogram labelling each axis by writing the description of the measured data on the horizontal axis and the frequency of occurrence on the vertical axis. Divide the horizontal axis into the same equal number of divisions as the number of classes. Divide the vertical axis into the same number of equal divisions to fit the frequency of occurrence range.
6. Draw a bar for each class with the height of each bar corresponding to the frequency of occurrence shown on the check sheet.

7. Interpret the histogram. Keep a watchful eye for skew and clustering problems.

Interpreting skew problems

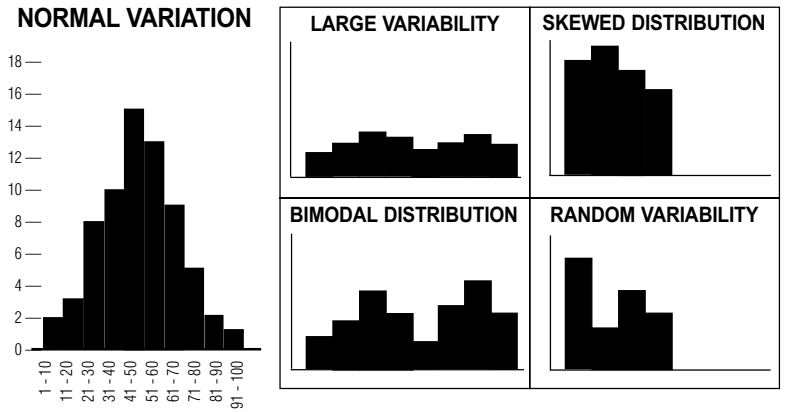
Data may be skewed to the left or right. If the histogram shows a long tail of data on the left side of the histogram, the data is termed left or negatively skewed. If a tail appears on the right side, the data is termed right or positively skewed. Most process data should not typically appear skewed. Data that is seriously skewed either to the left or right may be an indication that there are inconsistencies in the process or procedures, etc. It should be noted, however, that some process data is, by its very nature, skewed. This situation occurs in arrival processes (for example, people arriving at a McDonalds within a fixed unit of time) and in service processes (for example, the time it takes to wait on a customer).

Interpreting clustering problems

Data may be clustered on opposite ends of the scale or it may display two or more peaks indicating serious inconsistencies in the process or procedure or the measurement of a mixture of two or more distinct groups or processes that behave very differently.

Example

Histograms form several common shapes. A bell-shaped picture is usually a normal distribution and indicates a generally stable system. Any of these other shapes would indicate some special causes of variation and invites further inquiry.



INTERVIEW

The interview is a structured technique for collecting information from individuals or groups, including (perhaps most importantly!) your internal and external customers. If you have access to the people who have the information you need, interviewing either in person or on the telephone can be a very efficient means of data collection. It's often the best way to learn about your customers' needs and expectations.

Putting it to work

Tackle the interview just as a reporter would:

1. Before the interview, develop a list of questions. Ideally, this should be done in a group setting. Write down a "clean" version of the question list and take it to the interview.
2. Be sure to include follow-up questions to get at the information you really need.
3. When you conduct the interview, take notes of the responses. Remember to keep listening while you write.
4. If possible, bring along a note taker who can do the writing — allowing you to zero in on asking the questions and listening. Also consider bringing a tape recorder.
5. Stick with the list of questions, but don't get too locked in.
6. Verify your understanding of the interviewee's responses. Restate what you're hearing and ask whether your interpretation is accurate. (You are seeking information and testing understanding.)
7. If you're collecting sensitive information, ensure the confidentiality of the responses. Do not use respondents' names, identifiable quotes or other "identifier" information.

LIST REDUCTION

This tool helps in processing the output of a brainstorming session. The objective is to clarify the items so that all team members understand them and then reduce the items to a manageable number.

Putting it to work

1. Before the list of items (potential problem areas or solutions) can be shortened, everyone in the group must have a clear understanding of each item. The first activity, therefore, is for the leader or facilitator to review the items, asking if anyone needs clarification. If so, the suggester should be asked to explain in brief what he or she meant by the comment. The discussion shouldn't go beyond simple clarification at this point.
2. The team then identifies some "filters" — criteria that should be satisfied for an item to remain in consideration. Some filters for selecting problems are:
   - Does this problem lend itself to being solved by a team?
   - Is the problem within our control or influence?
   - Is it worth solving?

   Some filters for selecting solutions are:
   - Is it likely to solve the problem?
   - Is it feasible?
   - Can we afford it?

3. Keeping the agreed upon criteria in mind, group members vote on each item: "yes" if it satisfies the criteria, "no" if it doesn't. A simple majority (one-half the number in the group, plus one) keeps an item on the list; fewer votes mean the item is bracketed [...].
4. Items are bracketed, rather than crossed out, so the team can go back to them later if necessary. In general, the group focuses on — and continues to evaluate — only

the non-bracketed items on the list. However, since group members have not had an opportunity to react to any of the suggestions on the list, an individual member may request that a particular item remain under consideration until all have had a chance to react to it.

5. The process may be repeated, with different or more stringent criteria, until the list is reduced to about a half-dozen options. This represents a manageable number of options for applying some of the other evaluative tools.

Example

A maintenance team used list reduction to trim its brainstormed list of potential problems. Team filters included:

- Cost effective.
- Important to entire team.
- Able to implement quickly.
- Positive impact on quality.

Below is their final list. Note that the team has narrowed its focus to just two items.

MAINTENANCE TEAM
LIST REDUCTION OUTPUT

[1. Lack of work available.]
[2. Inadequate work tables.]
[3. Bad lighting.]
4. Lack of incoming quality control.
5. Process out of date.
[6. Lack of safety precautions.]

NOMINAL GROUP TECHNIQUE

The Nominal Group Technique (NGT) is a structured method for working toward consensus. Its strength is that it gives everyone in the team an equal voice in sharing ideas.

Putting it to work

NGT unfolds in two phases. **In Phase 1, Idea Generation**, the team follows these steps:

- Write a statement that describes an established goal, problem, or other subject. Put it on a flip chart or marking board, making sure all participants are focused on the topic and understand it.
- Each participant, working individually, proceeds to list as many ideas as they can in response to the statement.
- The ideas are then transposed to the flip chart. This can be done in one of two ways:
  - The ideas can be shared, one by one in round-robin fashion, by each person in the team. A recorder writes each idea on a flip chart, in full view of everyone. With this format, there's no discussion about the pros, cons or intent of any idea. If a participant's ideas are exhausted, he or she can pass. The round robin continues until all ideas have been recorded. (Do not number the items until later in the process.)
  - If confidentiality is an issue, the written ideas can be passed on to a recorder — who would then write them on the flip chart. This way, there's no way to link specific ideas to specific people.

To facilitate the next phase of NGT, it's suggested that the recorder leave space between items and that no more than five or six be on a sheet.

Phase 2, Priority Setting, is when the group indicates its preferences. Here's how it happens:

- Go over the list and ask for clarifications. Fine-tune the wording as needed.
- Number each of the items starting at the top. Give the same number to items that are similar in content and meaning.
- For lists of 20 or fewer items, give each participant five 3 x 4 Post-It notes. Ask each person to pick the five items that she or he feels are the highest priority. (For lists of 20 to 30 items, you may want to use seven Post-It notes; for lists of 30 or more you may want to use nine.) Instruct participants to write the number of each of their chosen items in the upper right-hand corner of a Post-It note. Also have them put a word or phrase in the middle of the note to describe the item. Remember, each item is on a separate note.
- When the participants are finished, they place their Post-It notes in front of themselves for ranking. Before giving a ranking, each participant should consider what makes this a priority item — such as cost, value added, importance and so on.
- Participants are asked to choose the highest priority item from the ones they have selected and to give it the highest number. If each participant has five Post-It notes, this number would be five. The number is written in the lower center of the note and circled. Participants are next asked to select the lowest priority item from the remaining items and to assign it a value of one. Then, of the remaining items, the participants select the highest-priority item and give it a four. This process continues until the other remaining items have been ranked. When participants have finished their rankings, they place each of the Post-It notes on the flip chart — directly next to the corresponding item as written on the flip chart during Phase 1.
- For each numbered item on the flip chart, add the rankings on the Post-It notes and record the total. Then count the number of Post-It notes for each item and record the total. The results show the team's ranking of all the items. The item with the largest number of points is deemed to be most important or significant to the team. (Knowing how many Post-It notes were received for a given item can prove useful in the event there's a tie in the rankings.)
- Before finalizing, the team should discuss the results to be sure there were no misunderstandings. Create a table showing (in descending order) the item number, a brief statement of each item, the number of votes it received and the number of participants voting for the item.

PARETO CHART

A Pareto chart is a form of vertical bar graph that breaks a problem into its parts and clarifies where improvement efforts should be focused. It's effective because it graphically demonstrates how seemingly small matters can cause big problems. The tallest bar or "big leg" of the Pareto represents the part that contributes most to the problem and targets where teams should focus their efforts for the greatest results. The name of the chart is derived from the Pareto Principle: 80% of the trouble comes from 20% of the problems.

Pareto charts are sometimes shown with a "cumulative line." This represents the percentage sum of the vertical bars, as if they were stacked on top of each other from left to right, and shows the percentage of the total problem that a category or multiple categories contribute to that problem.

Putting it to work

Follow these steps when creating a Pareto chart:

1. Select the problems or cause to be studied. This can be done through brainstorming, examining data or other means. Define the categories.

2. Select the appropriate unit of measurement for the categories to be assessed, and determine the time period for data collection

3. Collect the data by category for the specified time period (a check sheet is a useful tool here).

4. Draw horizontal and vertical axes on graph paper. On the left hand vertical axis, label the measurement values in equal increments.

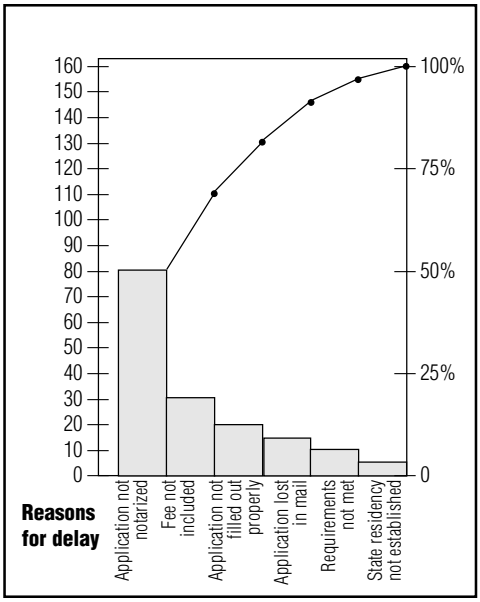
5. On the horizontal axis, order and label the bars by category, going from left to right in order of decreasing frequency or cost.

6. To include a cumulative line, label a percentage scale on the right-hand vertical axis, making sure the two axes are drawn to scale. Plot the percentage line showing the cumulative total with the addition of each category. All categories totaled should reach 100%

7. Compare the frequency or cost (or other measure) of each category relative to all the others.

THE PARETO PRINCIPLE:

80% of the trouble comes from 20% of the problems



Example

By looking at the Pareto chart above, it becomes obvious why application processing is being delayed. Much of the problem would be solved by eliminating the one cause that's most responsible for the problem.

PERT CHART

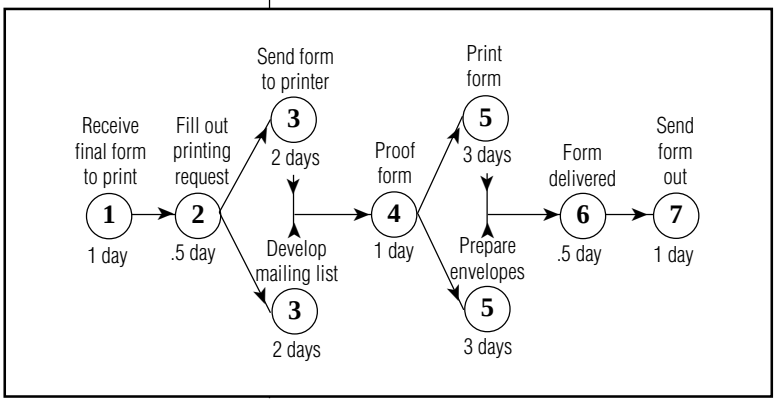
A PERT Chart (program evaluation and review technique chart) is a tool used for planning action and is designed to manage time. PERT Charts show the "critical path" or the minimum elapsed time that is required to complete a project.

Putting it to work

1. Before drawing the actual PERT Chart, you need to identify all the activities in your process or plan. Then put the activities in the order that they must occur. Also, determine if there are any activities that can be completed at the same time. Number each of the activities in the order that they must occur, giving the same number to activities that can be completed simultaneously.
2. You are now ready to draw the diagram. Place each number in a circle. Connect each of the circled numbers with an arrow. Above each arrow write in the activity and below each arrow write in the estimated time to complete each activity. Depending on the project, time can be minutes, hours, days or months.
3. Once the chart is complete you can see the critical path of your project and the minimum amount of time that will be necessary to complete the project.

Example

The Pert Chart below is mapping out the critical path for printing and distributing a new form.



RUN CHART

A run chart displays trends within observation points over a specified time period. It can be used to monitor a process to see whether or not the long-range average is changing.

Run charts are easy to construct and use. Points are plotted on the graph in the order in which they become available. It is common to graph the results of a process such as delays, errors, rework and so on as they vary over time.

Putting it to work

At its most basic, the run chart is nothing more than a single line showing a single measurement over time. Here are several key points:

1. Decide on what data to collect.
2. Gather the data. Collect 20-25 data points to detect meaningful patterns.
3. Build a graph, and on the vertical line, draw the scale related to the variable you are measuring – such as defects, delays, waiting time, complaints, and so forth.
4. On the horizontal axis, draw the time or sequence scale: hour, day, week, month, etc.
5. Plot the collected data. (Be sure to plot the data in the order it was collected. The sequence of the data points is critical.) Connect the data points to create a line.
6. Calculate the average, which is the sum of the measured values divided by the number of data points.
7. Interpret the data.

Important Tips

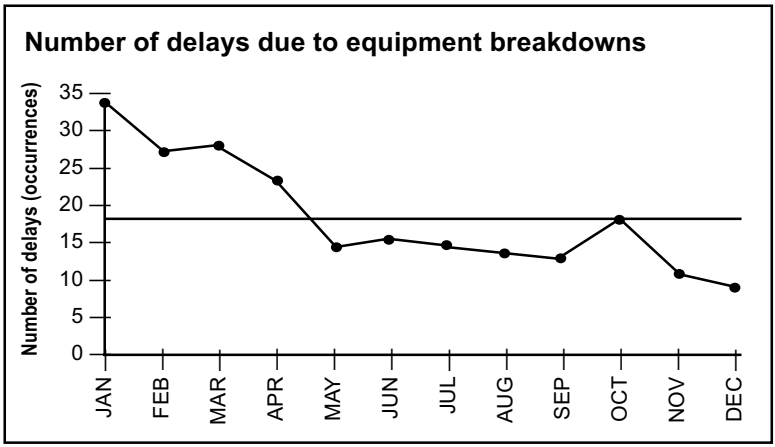
■ A danger in using a run chart is the tendency to see every variation in data as being important. The run chart, like other charting techniques, should be used to focus attention on truly vital changes in the process. For example, when monitoring any process, it is expected that we should find an equal number of points falling above and below the average. When six or more points "run" on one side of the average, it indicates a statistically unusual event. Such changes should always be investigated. If the shift is favorable, it

should be made a permanent part of the system. If it is unfavorable, it should be eliminated.

- An alternate type of pattern that can occur is a trend of six or more points steadily increasing or decreasing with no reversals. Neither pattern would be expected to happen based on random chance. Such a significant change calls for some research and analysis — and possible action.
- Look at the average. Is this really where you want to be relative to customer satisfaction?
- Turn the run chart into a control chart to see if the process is in control.

Example

The example below shows a year's worth of data. The team is using this run chart to track delays caused by breakdowns in equipment.



SCATTER DIAGRAM

A Scatter Diagram is used to interpret data by graphically displaying the relationship between two variables.

A scatter diagram can be used to validate "hunches" about a cause-and-effect relationship between types of variables. It displays the direction and strength of the relationship. For instance, it can help to answer the question: Will our error rate increase if we speed up the processing time?

Putting It to Work

1. Start with a check sheet containing paired observations of the two factors. (A minimum of 25 pairs of data is desirable.) Create a summary table of the data.

2. Draw a diagram labeling the horizontal and vertical axes. It is common that the "cause" variable be labeled the horizontal (X) axis and the "effect" variable be labeled the vertical (Y) axis. The values should increase up the vertical scale and toward the right on the horizontal scale. The scale on both the X and Y axes should be sufficient to include both the largest and the smallest X and Y values in the table.

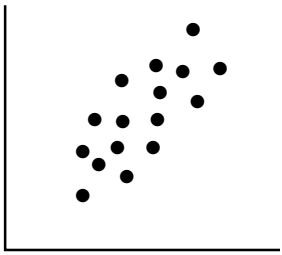
3. Plot the data pairs on the diagram by placing a dot at the intersections of the X and Y coordinates for each data pair.

4. Interpret the scatter diagram for direction and strength.

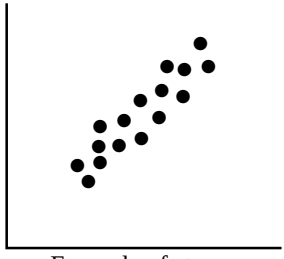
Interpreting the diagram

- A narrow band of points extrending from the lower left to the upper right suggests a positive correlation - as one factor increases, so does the other. Negative correlation means that the factors react opposite to each other.
- A diagram with a cluster of points or circular pattern, such that it is difficult or impossible to determine whether the trend is upward or downward sloping, indicates that there is no relationship between the two variables.
- Data patterns, whether in a positive or negative direction, should also be interpreted for strength by examining the "tightness" of the clustered points. The more the points are clustered to look like a straight line, the stronger the relationship.

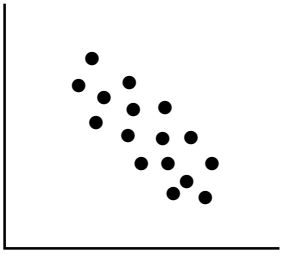
Examples



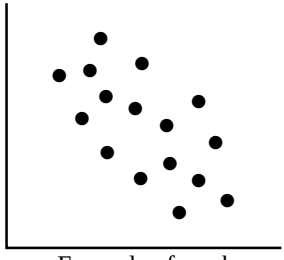
Example of
positive correlation



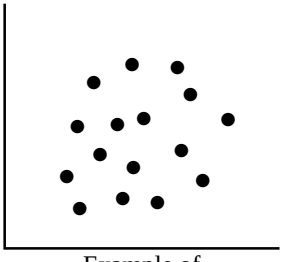
Example of strong
positive correlation



Example of
negative correlation



Example of weak
negative correlation



Example of
no correlation

SURVEY

Surveying is much like interviewing — but on paper. Instead of responding to interviewers, people answer items on a questionnaire. The major advantage is that you can get a great deal of information from a lot of people very economically. The downside is that people may interpret the questions somewhat differently than intended. Their answers may be ambiguous as well, and there's no opportunity to test understanding.

Putting it to work

Follow these simple steps to ensure a successful survey:

1. Identify the information you need.
2. Decide who has this information in its most reliable form.
3. Plan how you will use the information when you have it in hand.
4. Develop a series of questions that will enable respondents to provide the information accurately and unambiguously.
5. Keep the questionnaire short, simple and clear.
6. Try out the questions with several people to uncover any unclear questions. Conduct several "test surveys" to work out the bugs.

Questions can be "closed" with a limited number of responses from which to choose:
How long have you worked in your present job? Circle one:
Less the 1 yr. 1 - 3 years more than 3 years

Or survey questions can be "open":
How do you use the information combined in the monthly progress report?

Example

The sample questionnaire shown on the next page was used by a team to test reactions to a proposed Combined Petty Cash/Local Travel form.

Example:

COMBINED PETTY CASH/LOCAL TRAVEL QUESTIONNAIRE

Please take a minute to answer the following questions, then leave the survey on the table in the back of the room before you leave. If there's an area of concern that has not been covered, please let us know. Thanks for your time and valued input!

1. Do you like the concept of combining Petty Cash and Local Travel on one form? YES NO

2. Do you feel you would have occasion to use both sections of the combined form for one transaction? YES NO

3. Do you like the uniform heading and signature area? YES NO

4. Do you like the uniform size of this combined form? YES NO

5. Do you feel there is a advantage with this uniform size combination for filing purposes? YES NO

6. Do you like the idea of a total mileage concept vs. listing separate trips for Local Travel? YES NO

7. How much time do you feel this new form will save you on a monthly basis? _____ indicate minutes or hours

COMMENTS:

WEIGHTED VOTING

This tool enables teams to quantify the various positions and preferences of team members. It differs from criteria rating forms in two ways: first, no decision factors or criteria are used; second, individual member's votes are recorded, there is no discussion or effort to reach agreement on a single number.

Putting it to work

Using a flip chart, set up a grid as shown below, with the options listed horizontally and team members listed vertically. Give each person a number of votes to distribute in accordance with their preferences. As a rule of thumb, the number of votes should be about 1 1/2 times the number of options. Members then decide how to distribute their votes among the options to indicate their relative preferences. Keep in mind these few guidelines:

- Encourage people to spread their votes to represent their relative feelings about the options, rather than lump all their votes on a single favorite.
- Have members decide how they will distribute their votes (preferably jotted down on paper) before any votes are recorded on the chart.
- Ask members to show their votes for each option all at once by raising the number of fingers that represent their vote.
- Ask for and record votes by option, not by person. That is, call for the votes for the first option, the second and so on. Record all the votes so the team can see where agreements and disagreements occur.

Team Members	Option 1	Option 2	Option 3	Option 4
Totals				

Weighted voting does not make decisions. It merely provides information about where individual members stand

and how strongly. This information makes it easier to bring opposing viewpoints to the surface. This must be done if consensus is to be achieved.

Example
A team used weighted voting as part of its effort to reach consensus. Four options were on the table, so each person had six votes. As you can see, Option 1 received the most votes. Options 3 and 4 came in at a virtual tie.

Team Members	Option 1	Option 2	Option 3	Option 4
JIM	2	1	2	1
CLARA	1	0	1	4
SUSAN	3	1	1	1
JUSTIN	4	1	1	0
MARK	2	1	1	2
FRANK	1	1	3	2
Totals	13	5	9	10

NOTE: Some people prefer not to total the numbers for each option. This way, they guard against the risk that weighted voting will become just another mechanism for a win-or-lose outcome. This tool, like the criteria rating form, is not the decision-maker. The team is the decision-maker. Regardless of whether you total the numbers, the most important thing is that you use weighted voting as a vehicle for moving more closely to consensus.

"WHY" TECHNIQUE

Some of the tools for continuous improvement require number-crunching, graphing and analysis — but not all of them. Perhaps one of the most powerful tools is also one of the most basic. It has less to do with number crunching and more to do with simple curiosity. We refer to that old standby question: "Why?"

By asking "why," you can peel back the layers to discover the root cause of a problem. This may require you to ask "why" more than once — sometimes as many as five or six times. Keep probing to find why the symptom (or "effect") is occurring. You'll eventually come to the root cause.

Example

PROBLEM: SUPPLY ORDERS AREN'T FILLED ON TIME

1st layer | **WHY** aren't supply orders filled on time?
Because the supplies are not in stock.

2nd layer | **WHY** aren't the supplies in stock?
Because the supply shipment has not been received.

3rd layer | **WHY** hasn't the supply shipment been received?
Because the order was placed late.

4th layer | **WHY** was the order placed late?
Because the order/request for supplies takes 3 weeks to get approved.

5th layer root cause | **WHY** does the order/request for supplies take 3 weeks to get approved?
Because it is in transit for 12 days, going from one approval authority to another (total approvals needed = 5).

"WHY" TECHNIQUE + TREE DIAGRAM

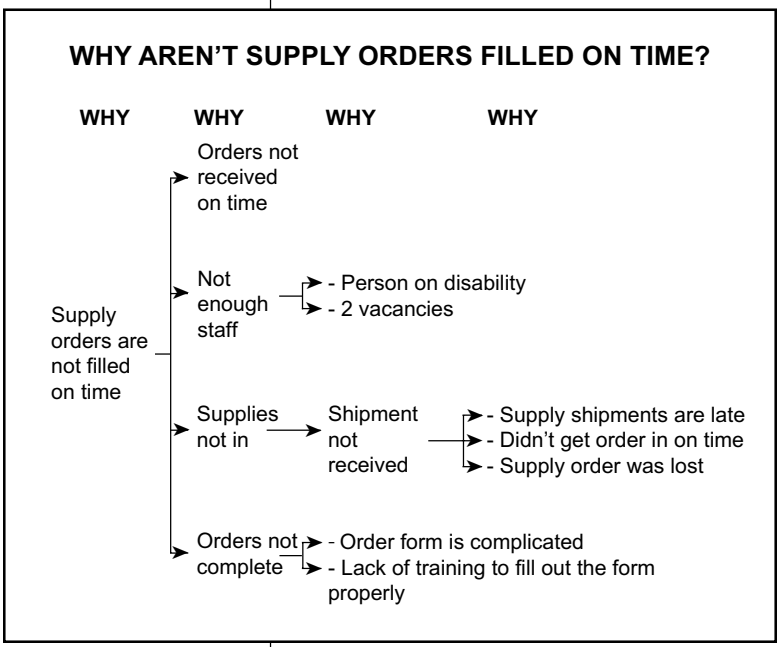
Some times you may want to use the Why Technique in conjunction with a tree diagram. This will provide a little more structure to the Why Technique and help you identify various root causes.

Putting it to work

Once you have identified a problem ask the question "Why did this problem occur?"(This is your first layer.) Then take the answer to that question and ask the question again. Continue to do this until you have uncovered the possible root causes of the problem. It may be necessary to ask "why" several times before you uncover all the root causes.

Example

The example below shows the use of the Why Technique with the Tree Diagram.



When to use which tool

Use . . .	**When you need to . . .**
Affinity Diagram	Organize into groupings a large number of ideas, opinions, issues, or other concerns.
Balance Sheet	Identify the pro's and cons' of various options.
Brainstorming	Generate, clarify and evaluate a sizable list of ideas, problems or issues.
Cause and Effect Diagram	Systematically analyze cause and effect relationships and identify potential root causes of the problem.
Check Sheet	Gather a variety of data in a systematic fashion for a clear and objective picture of the facts.
Control Chart	Monitor the performance of a process with frequent outputs to determine if its performance reveals normal variations or out-of-control conditions.
Criteria Rating Form	Evaluates various options based on selected criteria.
Flowchart	Describe an existing process, develop modifications or design an entirely new process.
Force Field Analysis	Identify the driving and restraining forces that affect process performance.
Gantt Chart	Explain implementation plans to management and workers, and ensure an organized, objective implementation.
Histogram	Display the dispersion or spread of data.

UNION'S ROLE IN QStP

Empower employees to develop strategies to improve government services, enhance their job satisfaction, and protect the security of their jobs.

1. **Design a better system that provides better public services**

2. **Increase worker voice and involvement.**

3. **Identify problem areas or prevent serious problems that lead to contracting out or other issues that affect employment security.**

4. **Develop practices and relationships that provide an opportunity to show how the union can add value and contribute to effective government.**

UNION CONTACT INFORMATION

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