

ISO *Q* **UEST**

TQM FOR AN ISO WORLD

QUALITY TOOLS DEVELOPMENT



QUALITY IS A JOURNEY...

VISION *Q* **UEST**

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QUALITY TOOLS DEVELOPMENT

THE JOURNEY BEGINS

Successful Quality improvement does not just happen. Success depends on training, trust building, hard work, having the necessary tools, and above all, commitment.

This book was designed to help organizations develop the tools and skills they need to implement quality processes. It will teach new skills and develop those skills that are inherent in all of us. It will provide tools critical for writing good processes and Creative Problem Solving. The development of highly effective organizations will not happen overnight. It takes time to build relationships and to obtain the values that lead to success.

With the use of this book and all other collateral materials, organizations will have the foundations they need to develop quality processes and good creative decision making.

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THE LANGUAGE OF QUALITY

Think of a product that you associate with quality. What makes you think that it is a quality product. Often, we associate price with quality. For example, we think of products such as Mercedes-Benz cars, Nikon cameras, or anything bought on Rodeo Drive as quality products. But when we talk about quality here, we have a very specific definition.

Quality defined:

Efficiently conforming to customer requirements both internal and external.

Let's break it down.

Customer:

Anyone that receives an output from any of your processes, both within the company and external to the company. Most employees of companies deal more often with internal customers rather than external customers. However, all processes eventually lead to the external customer.

Requirements:

The needs, wants and/or expectations of the customer.

Conformance:

The ability of the output of any given process to meet all of your customer's requirements.

Efficiently:

The ability to meet your customer's requirements with a minimum of effort, time, expense, or waste.

If you wish to avoid deviating from your customer's requirements, there are only two ways to do so. The first way is to correct any mistakes you have made or, prevent mistakes from occurring in the first place.

Both of these take time and have costs associated with them. In the long run however, it is more cost effective to prevent mistakes than to correct them. Often, it is even impossible to correct some mistakes after they have been made. It is also extremely hard to win back the confidence of a customer if you are constantly trying to correct preventable mistakes.

There are many things we do to try and avoid making mistakes, we try on clothes to make sure they fit before we buy them, we look both ways before crossing the street. We even test drive the car before we buy it.

Here are some great ways to avoid making mistakes at your customer's expense:

Ask for your customers requirements:

How can you provide output from your process unless you know what your customer wants? Do not make assumptions.

Ask for specifics:

For example: A customer wants his car painted things to ask would be:

- What color?
- How many coats?
- When needed?
- Do they want pin striping?

As you can see, there may be many things the customer requires that need to be specifically pointed out so that you do not provide them with a blue car when they wanted a green one.

Test for understanding:

After you have asked for your customer's requirements, tell them back to the customer and ask if that is what they require. If it is not, redefine the requirements until they meet the customer's expectations.

Measuring Quality

Since quality means meeting our customers expectations with no variance to their requirement's, then there is only one way to know if we are in conformance:

We must measure our output against the requirements of our customer.

Since quality is the responsibility of all employees of an organization, then measuring for quality must also be everyone's responsibility. Measuring quality and seeing if we are getting any better in our performance is what quality improvement is all about.

If we can not measure the output of our processes as it relates to customer expectations, then there is no way that we can tell if we are improving.

Cost of Quality

The cost of quality is a specific way of developing awareness of the financial impact of poor quality. The reason we focus on quality to be aware of the amount of money it represents.

There are three elements to the cost of quality:

- Cost of conformance
- Cost of non-conformance
- Lost opportunity costs

Let us examine these in detail.

Cost of conformance:

This is the cost associated with ensuring that the output of the process meets the customer's requirements. It includes prevention, inspection, appraising, and measuring.

For example:

It takes time to organize a meeting. However, a well planned meeting will make the meeting more productive and require less time.

Using spell check to prevent spelling errors in documents.

Other costs associated here are:

- Training quality techniques
- Taking the time to get agreement on customer requirements
- Inspecting the input and output of the processes

Cost of Non-conformance:

This is basically a way of measuring in dollars what it costs the organization to either not meet or to exceed meeting a customer's requirements.

Some examples of not meeting requirements are:

- Incorrect customer invoices.
- Incorrect bills of lading.
- Unsigned expense reports.
- Not signing time cards or not punching in/out.
- Meetings that do not follow an agenda.

Some examples of exceeding customer requirements are:

- Notes and memos given to people who do not need them.
- Typing and rewriting notes that could be left hand written.
- Three coats of paint when only two were needed.

It is estimated that the average American company loses 15% of its annual revenue to non-conformance!

Lost opportunity costs:

This refers to money that is not being made. When a company does not do a good job of meeting their customer's requirements, the customer may leave and do business elsewhere. You can probably think of a company that did not meet your expectations and now you no longer do business with them.

Another way to look at it is this:

In the case of a transportation company, a truck making deliveries that is only half full is experiencing lost opportunity in that it is missing the revenue it could be producing if the truck were completely full.

PROCESS WRITING

The ability to write productive and accurate processes that fully meet your customer's requirements is the key to total quality. Processes describe and outline the actions needed to conform to customer expectations.

Process defined:

The step by step instructions that describe the actions needed to be done in order to meet customer requirements.

A written process is basically the directions to accomplishing a given task. Just as we refer to the instruction manuals to use devices such as VCR's, TV's, Stereo's, and building model airplanes, our work processes tell us how to accomplish our task so that it conforms to customer expectations.

There are many reasons that we use written processes. Some of the more important ones are:

- To meet customer expectations consistently.
- To have the ability to measure process output.
- To have the ability to measure process input.
- To be able to cross train and retrain new and existing employees.

A written process gives us the clear understanding of the tasks requirements by providing us the following key elements.

- Knowing what the requirements of the customer are.
- Knowing what inputs we need to meet those customer requirements.
- Knowing what actions must be applied to the inputs in order to produce output.
- Being able to verify that correct inputs are being received.
- Being able to verify that correct output is being produced.

Let's look at the key elements one by one and determine how they are produced.

Customer Requirements:

There is only one way to know what the customer requires and that is to ask them. Be sure to ask as specific questions as possible in order to be sure that you are meeting all of the customer's requirements. Then, test for understanding in order to insure that you heard the requirements the same way that the customer meant them.

Input:

Input is the product that you need in order to apply work to it so that you produce output that meets your customer's requirements. In this case, you are the customer of the person or company providing you with the input. It is necessary for you to be as specific as possible to your supplier so that they can meet your requirements in order for you to meet your customer's requirements. Be sure and test for understanding so that your supplier heard hear requirements the way that you meant them.

Output:

Your finished product that fully meets your customers expectations.

Measuring Input:

One step of your process must be to determine if the input from your supplier meets your requirements. To do so, the input must equal whatever your specifications were when you negotiated you requirements as a customer.

Measuring Output:

Another step of your process must be to determine if your output equals your customer's requirements. To do so, the output must equal whatever specifications your customer negotiated from you.

The following pages graphically demonstrate process flow and the identification of customers and suppliers.

CREATIVE PROBLEM SOLVING AND QUALITY IMPROVEMENT

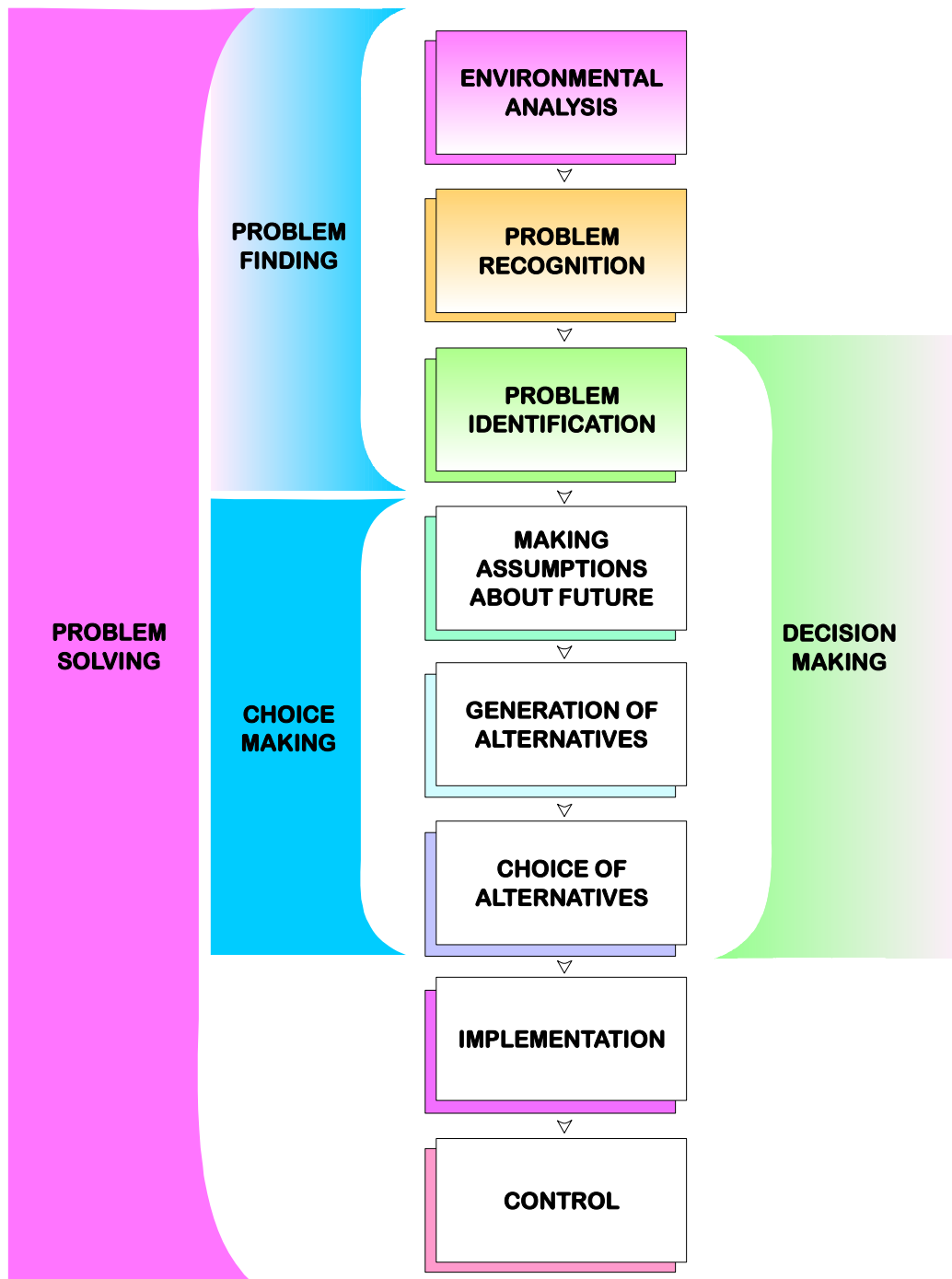
One of the most confusing aspects of Quality Improvement is determining when to use Creative Problem Solving and when to use the Quality Improvement Process. Please refer to the following page and it will outline when to use the CPSP or QIP.

Another one of the more confusing aspects of Quality Improvement is that the Quality Improvement Process is not designed to improve current processes. It is designed to write processes that improve quality. This is a step by step process to develop customer requirements into actions that develop input into specific requirements that meet customer expectations. It certainly can be used to improve current processes, but even if no process yet exists to meet a customers expectation, the QIP can develop a process that will. If a company is in the startup phase and has no processes at all developed for its customers, the QIP is the best way to identify all of the steps needed to meet the customer's requirements.

CPSP OR QIP?

Creative Problem Solving Process		Quality Improvement Process	
<p>A general process for making change in</p> <ul style="list-style-type: none"> • Systems • Work processes • Management processes • Results • Conditions 	<p>What it is</p>	<p>A tightly focused process for ensuring conformance of</p> <ul style="list-style-type: none"> • A specific product • A specific service <p>to the requirements of its customers.</p>	
<ul style="list-style-type: none"> • Definition of problems • Analysis of data • Understanding of causes • Creative ideas • More alternatives • Teamwork • Commitment 	<p>The process fosters</p>	<ul style="list-style-type: none"> • Elimination of unneeded work • Prevention of problems • Shared responsibility • Strong customer / supplier communication lines • Evaluation of work processes • Critical measurement • Confidence in results 	
<ul style="list-style-type: none"> • There is a gap between what is happening and what you want • You want to move from a vague dissatisfaction to a solvable, clearly defined problem • You are not sure how to approach an issue 	<p>Use it when</p>	<ul style="list-style-type: none"> • You need to improve the quality of a particular, currently existing output • You do not have agreed upon customer requirements for an output • You are about to produce a new output, the need for which has recently been determined 	
<ul style="list-style-type: none"> • Problem you identify is a lack of quality or an inability to assess quality • The recommended solution involves producing specific output <p>Then go to Quality Improvement Process</p>	<p>One process can lead to the other when</p>	<ul style="list-style-type: none"> • Evaluation of process capability shows that current work process cannot produce output that meets customer requirements • Evaluation of results indicates that the work process did not product quality output <p>Then go to Problem Solving Process</p>	

CREATIVE PROBLEM SOLVING PROCESS



CREATIVE PROBLEM SOLVING

The creative problem-solving process consists of the eight stages identified on the previous page.

Constant Environmental Analysis

Problem solver's must constantly scan their environments-external and internal-for signs of problems. They must also keep environmental factors in mind during the other steps of the decision process. Some firms, such as Anheuser-Busch, have sophisticated environmental-analysis systems to assist their people. Such systems contain information on customers, competitors, the economy, and other important factors. They are computer based and often use computer simulations. Rapidly changing and increasingly complex environments make this process absolutely critical. While analysis of the environment tends to be a rational process, interpreting the meaning of the information obtained often requires the use of intuition. As you will see later in this section, people and groups have personal preferences for how they gather and evaluate information, which can greatly affect the kinds of decisions they make.

Recognition of Problems or Opportunities

A problem solver is concerned with either **problems or opportunities**. In the recognition stage, problem solver's depend on formal and informal information systems-and often on their intuition as well, to alert them to a possible problem. In the recognition stage, problems are not precisely defined. Rather, the problem solver often has a vague feeling that something is amiss or that a tremendous opportunity exists.

Research by W. F. Pounds has shown that most people simply do not ask themselves often enough, "How do we know that we have a problem?" Problem recognition tends to be informal and intuitive. Pounds indicates that people might be able to find problems in four ways:

1. Comparing a current with a past experience.
2. Comparing a current experience with current objectives or plans.
3. Comparing performance with models of desirable outcomes.
4. Comparing performance with that of other organizations or subunits.

The most preferred of these methods would be the second-because people should always be striving to achieve current objectives. However, Pounds found that the first method is most often used, whereas the third and fourth are seldom used. Pounds' studies reveal that people do not usually compare current performance against current objectives; rather, they rely on other benchmarks, such as last year's performance, as a basis for comparison. He suggests that "consequently they may be defining the wrong problem or may not recognize one when it exists."

Later research by Marjorie A. Lyles and Ian I. Mitroff confirmed that problem recognition is typically informal and intuitive. They collected case histories from top managers in major organizations. Eighty percent of the managers reported that they had recognized the existence of a problem before being told about it by subordinates or supervisors or before it appeared in some type of formal information system, such as a financial statement. When asked how they knew about those problems, they replied, "informal communication and intuition."

Too often, people fail to recognize problems at all. More attention must be given to problem recognition and identification if CPS is to be successful. For example, at Wang Computers, successive CEOs failed to recognize the problem of not having a personal computer as part of the company's product line, a failure that eventually led to bankruptcy. If they had been more alert, and had recognized this problem, Wang might have prospered.

Finding problems or opportunities depends on constant environmental scanning and analysis. Successful companies are continually alert, always monitoring, always watching. They actively pursue problems and opportunities. For example, in service industries they might perform customer satisfaction surveys to determine potential problems. They might also use customer complaint records, focus groups, and employee input.

Alert people recognize weak signals as well as strong ones. In *Innovation and Entrepreneurship*, Peter Drucker observes that many people fail to recognize opportunities and, hence, fail to take advantage of them. Apparently, very few people actively seek opportunities. However, the entrepreneurial person, that is, one who acts like an independent businessperson, is constantly aware of opportunities and takes advantage of them. Some companies encourage entrepreneurship among their employees; most do not. However, more top-level managers are beginning to do just that. In high-technology areas, sophisticated techniques, such as market-opportunity analysis, have been developed to help identify opportunities for developing and applying new technologies.

Problem Identification

The creative problem solver seeks to determine the real problem. During the recognition stage, the person knows that a problem exists but is not sure exactly what it is. In the identification stage, the person attempts to get at the roots, or cause, of the problem. In most organizations there is a complex series of problems; frequently, however, one or a few of them seem to cause most of the others. For example, lower profits may have resulted from lower sales, which may have resulted from reduced advertising as part of a cost-cutting program. Inadequate worker performance may be the result of poor leadership, inadequate training and knowledge, a change in the quality of materials, improper procedures, boredom, excessive workloads, pay scales that seem unfair, tacks of penalties for poor performance, and lack of rewards for excellent performance, to name

a few possible causes.

The people must determine which problem or problems are the causal ones. Errors are highly likely at this stage because of differences in people's perceptions and self-images. People solve problems according to their perceptions of them. If they misperceive a problem, their efforts to solve it will be misdirected. A person's self-image often affects his or her perceptions. For example, a person with a weak self-image might perceive a threat in a situation where none exists in reality.

Two management consultants, Charles Kepner and Benjamin Tregoe, suggest that asking a few questions often helps to identify the problem.

- Describe as specifically as possible the nature of the symptoms.
- Describe where the symptoms occurred.
- Describe when the symptoms occurred.
- Describe the extent of the symptoms.
- Describe any changes that occurred.
- Do the changes explain the symptoms?
- If not, examine other changes.

IKEA Furniture, the giant Swedish furniture chain, saw an opportunity based on cost. It has seized that opportunity and become the store that customers hate to love.

CRITERIA FOR A SUCCESSFUL SOLUTION

As part of the problem-identification stage, problem solver's must establish criteria for a successful solution. They must determine and specify, preferably both quantitatively and qualitatively, what constitutes a "good" decision. In other words, before they choose a solution they must decide what it must accomplish. They also need to identify desirable, but not necessarily critical, criteria. In the choice stage, they will compare each alternative to these criteria in order to make their choice.

A.M. Castle, one of the nation's largest suppliers of metal products, has based virtually all of its strategic decisions on one critical criterion: Does it improve customer service? As a consequence, the firm has developed numerous innovative programs to assist customers, including designing specific products for them, helping them assess their needs, and showing them how they can improve their profitability. A. M. Castle's market share and profits have increased dramatically as a result.

DETERMINING KEY SITUATIONAL FACTORS

Before making assumptions and generating alternatives, it is necessary to identify the key situational variables. These are the factors that are prominent parts of the problem, that will influence your ability to solve the problem, and that will be included in the

solution. In making leadership choices (how to influence others' motivation), for example, the key factors are usually a manager, a subordinate, the work group, the task, the organization's structure and culture, and other critical variables.

Making Assumptions About the Future

After analyzing the environment and recognizing and identifying the problem or problems, decision makers must make assumptions about the conditions of various elements in the decision situation. In planning, for example, it is necessary to make an assumption about whether competitors will continue to compete in the same way. In organizing, an assumption might be required about the probable effectiveness of giving someone more work to do. In leading, it might be necessary to make an assumption about how someone would react to a particular type of managerial style. On the basis of these assumptions, problem solver's generate and evaluate alternatives and make choices.

Generating Alternatives

Once an employee has recognized a problem, identified the underlying cause or causes, and made assumptions, he or she must generate alternatives to solve it and related problems. Realistically, unless the problem is extremely simple, alternative solutions need to be generated for a model of the situation-that is, for a simplification of the real situation. The search for alternatives can be time consuming and complicated. Herman Miller, probably the nation's most innovative furniture design company, encourages its employees to generate numerous alternatives, even wild and crazy ones, in the hope of uncovering something special. It has even designed its office areas to provide plenty of informal gathering spaces to encourage the interchange of ideas.

Evaluating and Choosing Among the Alternatives

After generating a set of alternative solutions, the person must choose one or more alternatives that will meet the criteria for a successful solution. Determining the likely outcomes of these various alternatives allows for a better comparison with the criteria and improves the likelihood that the choice eventually made will be an appropriate one. Choosing an alternative seems like a rational process, but in fact it is often intuitive, involving social and political relationships. Even a rational decision-making process may involve many complex variables, sometimes making the situation controversial and almost untenable. For example, the decision to launch a new product involves many complex variables. Top managers may disagree on the right action to take. Many times, therefore, the CEO makes a choice based on intuition.

One factor that greatly affects the choice of alternatives is the problem solver's risk propensity, or willingness to undertake risk for possible gain. Some individuals are willing to take high risks; others are not. Research by Danny Miller reveals that top managers with a high risk propensity often make choices that leave their organizations in dire straits. Are you willing to take risks?

Conditions Under Which Decisions Are Made

The conditions under which people make decisions have a tremendous impact on the choices they make. The following table shows three possible degrees of certainty about the outcomes of decisions. The less routine, the less anticipated, and the more complex the problem, the more uncertain the decision-making environment usually is.

Decision Making Under Certainty				
Problem	Alternative 1	100%	Outcome 1	Alternatives are known, conditions surrounding each are known. Outcomes are certain.
	Alternative 2	100%	Outcome 2	
	Alternative 3	100%	Outcome 3	

Decision Making Under Risk				
Problem	Alternative 1	70%	Outcome 1	Alternatives and related conditions are not known, but probabilities are estimable. Outcomes are unknown.
	Alternative 2	20%	Outcome 2	
	Alternative 3	10%	Outcome 3	
		100%		

Decision Making Under Uncertainty				
Problem	Alternative 1	Unknown	Outcome 1	Alternatives: Number of alternatives, related conditions, and probabilities are unknown.
	Alternative 2	Unknown	Outcome 2	
	Alternative 3	Unknown	Outcome 3	
	Alternative N	Unknown	Outcome N	

Problem Solving Under Conditions of Certainty

Certainty exists in a problem-solving environment when the decision maker can predict the results of implementing each of the alternatives 100 percent of the time. For example, when a city's treasurer leaves the city's money in a bank overnight, he or she knows exactly how much interest that account will generate. The treasurer also knows with certainty the results of other alternatives, such as not leaving the money in the overnight account. people seldom know with 100 percent certainty the results their decisions will have. Many times, however, they act as if they did.

Problem Solving Under Conditions of Risk

Under conditions of risk, problem solver's do not have complete certainty about the outcomes of their actions, but neither are they completely uncertain about what might result. Rather, they can assign a probability to the outcome of each alternative, if it were

to be implemented. Probabilities are usually expressed as a percentage—for example, a 10 percent chance of occurrence.

Risk is probably the most frequent situation confronting a people. When a person believes there is a one-in-ten chance that a new pay procedure will fail, but a nine-in-ten chance that it will succeed, he or she is making a decision under conditions of risk.

Problem Solving in Uncertain Environments

Uncertainty exists when people cannot assign even a probability to the outcomes of the various alternatives generated by the problem-solving process. People may not even know about all the alternatives. Uncertainty forces people to rely on hunches, intuition, creativity, or "gut feel." It is not that the numbers are not analyzed; they usually are. However, the person must also rely on nonrational decision processes. Unstructured, complex, unanticipated situations almost always occur in uncertain environments. For example, when Sony released Data DiscMan, it had no idea how successful the product would be. Sony's managers were working in an uncertain environment. They were unsure about the probabilities of various demand levels.

Types of Problems and Decisions

Structured Versus Unstructured Problems

Structured problems are those that occur routinely and have readily identifiable attributes (the factors involved and their interrelationships). They have standard, almost automatic solutions, often referred to as programmed decisions. When a student's grade-point average falls below a certain level, the student is sent an official warning. When a computer signals a malfunction, a maintenance person is dispatched to fix it. Both of these cases illustrate recurring, routine events that trigger a structured response.

Unstructured problems are nonroutine, complex problems with difficult-to-identify attributes. They lead to unprogrammed decisions. Normally, unstructured problems are being faced for the first time. One of the most complex unstructured problems ever analyzed is how to rid Los Angeles of smog. Biology, earth sciences, chemistry, and physics are all involved. Industry, automobiles, and even drive-through hamburger stands are major issues. A 500,000-equation computer simulation has been developed to help solve the problem, but its developer admits that the model is only as good as the assumptions it is based on—many of which are the result of complex, often intuitive thought processes. Because structured responses cannot be employed, nonroutine problems demand that people engage in creative problem solving. Solving these types of problems requires intuition, creativity, and heuristics (rules of thumb).

Some problems are clearly structured, some clearly are not. Most problems, however, vary in the degree to which the factors involved are readily identifiable and can be

related to each other. For example, a problem of low employee motivation is more structured than the problem of long-term planning for a company, which tends to be more unstructured.

Anticipated Problems Versus Surprises

Another way of looking at problems is to consider whether they were anticipated or were surprises. Good people anticipate the problems that may occur as a result of most, if not all, of their actions and decisions. They should anticipate the potential problems of any situation in which they find themselves, regardless of whose decisions brought them to it. Such monitoring prepares them to anticipate a diverse range of problems having to do with productivity, motivation, concerns about pay, concerns about not being promoted, the failure of an advertising campaign, or failing to gain a certain market share.

Some problems are surprises. Equipment breakdowns, power failures, a competitor's strategy, or a sudden loss of market share may take a person by surprise. The less complex of these surprises may be handled by routine solutions. Good people recognize that, over time, certain events may occur. These surprises can be anticipated to some extent. Absenteeism, tardiness, and similar personnel problems, for example, may be handled through specific policies and rules. While the exact timing of this type of event is unknown, its occurrence is almost assured.

On the other hand, any person may face a crisis, the most extreme form of unanticipated problem. It often requires quick problem-solving actions under highly stressful conditions, as well as the expenditure of considerable resources.

The ability to handle a crisis is a key problem-solving skill. There is evidence that people, especially in the upper levels of an organization, are frequently forced to manage crises. Some of the better-known crises in recent years were the Tylenol cyanide poisonings in 1982 and 1986, the Delta 1011 crash in Dallas in 1985, and General Motors' loss of \$4.5 billion in 1991.

Individual Versus Group Decision Making

Up to this point we have spoken of the decision maker as an individual. However, in many organizations groups make many decisions. If current trends continue, groups will be making even more decisions in the future. General Mills, for example, has already converted 60 percent of its plants to a group decision-making approach, with managers facilitating the groups' problem-solving efforts. Future plans call for all of General Mills' plants to be run by these autonomous work teams.

Managers must choose whether to use individual or group problem-solving processes. If groups are used, managers must choose the type of group that fits the situation best. They must be able to pick not just the type of group but the specific techniques it will

use. Criteria for choosing an individual or group decision-making process will be described later in the chapter.

Major Types of Decision-Making Groups

Group processes can raise the level of creativity in problem solving because more people will generate more ideas and people can build on the ideas of others. There are three major types of problem-solving groups: the interacting group, the nominal group, and the Delphi group. These groups are similar, yet distinct. Most groups are interactive. Nominal and Delphi groups are designed to overcome some of the problems interactive groups encounter, such as domination by a member with a strong personality. Generally speaking, there are many types of interactive group techniques, but only one major nominal group technique and one Delphi technique.

Interacting Groups

Interacting groups meet face-to-face and have an open interchange of ideas. They are usually unstructured, although many have an agenda and objectives. In creative problem-solving situations, interactive group meetings usually begin with the group leader stating the problem. An open, unstructured discussion follows. Problem recognition and identification, the generation of alternatives, and choice processes are focal points. A simple majority usually controls the eventual result. Three highly productive, interactive, creative group processes are brainstorming, storyboarding, and the lotus blossom technique.

Brainstorming

Brainstorming is a group creative problem-solving process that focuses on the following procedures:

1. No negative feedback is allowed on any suggested alternative until all alternatives have been generated.
2. Piggybacking on other people's ideas is encouraged.
3. Quantity of ideas, not quality, is the key. Evaluation comes later.
4. Free thinking is pursued. Let the "wild and crazy" ideas flow.

Brainstorming sessions have a leader and a recorder; the recorder writes the ideas, usually on a board, where all participants can see them. Sessions last about thirty minutes. There are usually six to ten participants. Ideas are evaluated after the brainstorming process has been completed. Brainstorming is especially useful for generating alternative solutions. It is often used in advertising but can be used to solve any well-defined problem. Brainstorming is the most widely used group idea generation technique. A version of brainstorming was used by Honda's engineering team to develop the highly fuel efficient engine for the 1992 Honda Civic.

Storyboarding

Storyboarding is a structured but flexible brainstorming process designed to identify major issues and then brainstorm each of them. In this technique participants put together a complete picture ("story") of the problem, one piece at a time. The "story" is then transcribed for all to see, usually on some type of wallboard. Storyboards involve two thinking sessions—one creative, the other critical. Basic brainstorming rules are followed in the creative thinking session. In the critical session, ideas are evaluated and the list of ideas is reduced to a manageable number. Storyboarding is good for analyzing a problem as well as generating alternatives. Implementation may also be an issue for a storyboard. A leader and recorder are used in a group that ranges from six to ten participants. Each thinking session lasts about thirty minutes. Storyboarding is used to solve complex, less well-defined problems—for example, determining what to do about low levels of worker motivation, a problem in almost all industries. PepsiCo, Disney Companies, and Sun-Trust Banks are just a few of the hundreds of major firms that use this technique.

Lotus Blossom

Lotus blossom is a creativity technique developed by the Japanese that uses a core thought as the basis for the expansion of ideas into an ever-widening series of surrounding windows (or "petals"). The core idea is surrounded by eight windows, each of which becomes the core thought for another set of eight windows. The process begins by using the core thought to trigger other thoughts, which are then placed in the eight surrounding windows. Each of these new core thoughts is then brainstormed for related thoughts. As with the other two techniques, the emphasis in lotus blossom is on generating quantity; the resulting ideas may be evaluated subsequently.

Lotus blossom is especially useful for developing future scenarios. Each scenario, in turn, might become the core of another round of brainstorming until all key issues have been identified. For example, if the core thought is future trends in education, the eight surrounding thoughts might be computer usage, videos, the instructor's role, types of students, textbooks, facilities, funding, and classroom pedagogy. Each of these would then be the subject of a brainstorming session. The eight ideas surrounding computer usage might be presentations, laptops, required features, additional features, integration into classes, data base/image, testing, and ethics.

Nominal Groups

Andre L. Delbecq and Andrew H. Van de Ven originated the nominal group technique in 1968, partly as an outgrowth of their dissatisfaction with interactive group processes. A nominal group is more structured than an interactive one. It intentionally eliminates much of the interpersonal exchange of the interacting group. The primary purpose of this process is to eliminate dominance of the choice process by one or a few people. It follows four steps:

1. Group members independently write down their ideas about the group's problem.
2. Each group member then presents each of his or her ideas to the other members, one at a time. Each idea is summarized on a chalkboard (or some other device) so that all the members can see it. No ideas are discussed until all of them have been presented and recorded.
3. An open discussion of ideas follows, but only to clarify ideas that some members do not understand. No attack or defense of ideas is allowed.
4. Next, a secret ballot is held. Group members list their top ideas in order of priority. The ballots are tallied, and then a second round of voting usually occurs. The nominal group's eventual decision is a pooled outcome of this vote.

Advantages and Disadvantages of Group Decision Making

Groups offer six advantages over individual decision making:

1. The group can provide a superior solution. Groups collectively have more knowledge than an individual. Interactive groups not only combine this knowledge, but create a knowledge base that is greater than the sum of its parts as individuals build on each other's inputs.
2. There is a greater likelihood that the final decision will be accepted when those who will be affected by it or must implement it have a say in making it.
3. Group participation leads to a better understanding of the decision.
4. Groups help ensure a broader search effort.
5. Risk propensity is balanced. Individuals with a high risk propensity often fail. Groups moderate this propensity. Groups also encourage the risk avoider to take more risks.
6. A collective judgment is usually better.

On the other hand, group decision making has certain liabilities. Among them are the following:

1. In interactive groups there is pressure to conform. Sometimes these groups become guilty of what is known as group think, in which people begin to think alike and new ideas or ideas that are contrary to the group's ideas are not tolerated.
2. One individual may dominate the interactive group, with the result that his or her opinions, not the group's, are accepted. Nominal groups are designed to overcome this problem. Delphi groups usually do not have this problem because the participants never meet face to face.
3. Groups typically require more time to come to decisions than individuals do.
4. Groups usually make better decisions than the average individual, but they seldom make better ones than the superior individual. In fact, a superior performance by a group may result from the efforts of one superior individual.

5. The total time spent by a group to solve a problem may negate the advantages of the decision it reaches.
6. Groups often make riskier decisions than they should. The propensity of groups to endorse a riskier position is known as the risky shift.

Behavioral Aspects of the Decision Process

Decision making in an organization seems to follow one of two behavioral models: economic and administrative. The economic model revolves around the rational, systematic perspective discussed earlier; the administrative model focuses on the psychological, interpersonal aspects of decision making. For many years, the economic model was believed to be the way decisions were actually made.

We now know that the administrative approach is the more realistic of the two. People simply do not make decisions in a strictly rational manner. Rather, various psychological and interpersonal factors affect the process.

The Economic Model of Decision Making

The eight-stage model of decision making provided earlier, analyzing the environment, recognizing a problem, identifying the problem, making assumptions, generating alternatives, making a choice, implementing the choice, and controlling-follows the economic perspective. It describes how decisions are made from a conceptual, analytical viewpoint. The assumptions underlying this classical, or economic, model follow:

1. Objectives are known and agreed upon.
2. The existence of the problem is recognized and its nature has been determined.
3. The consequences of implementing each alternative are certain, or a probability may be assigned to each.
4. Criteria for the best decision are known and agreed upon. Decision makers will seek to maximize their situation by choosing the "best alternative" indicated by these criteria.
5. People are rational. They can assign values, order preferences, and make the best possible decision.
6. People have complete knowledge of the situation.

The Administrative Model of Decision Making

Research by Nobel laureate Herbert A. Simon, management researcher James G. March, and others reveals that decision making is often dominated by nonrational social and political processes. Moreover, these researchers have found that the assumptions of the economic model do not conform to reality. Their combined efforts have led to the

construction of the administrative model of decision making. This model is based on a concept identified by Simon and known as bounded rationality. It suggests that decision makers are restricted in the decision process and must settle for something less than an ideal solution. The administrative model is based on the following assumptions:

1. Objectives of the decision are often vague, conflicting, and not agreed upon.
2. Often people do not recognize that a problem exists.
3. People often do not go through the identification process and do not have a clear idea of the nature of the problem (this has been called "making an error of the third kind").

Decision makers and problem solver's solve models of their world. These models never encompass all the variables, facts, or relationships involved in the actual problem. Therefore, if and when rationality is applied, it is applied only to a part of the total problem. Research reveals several biases in the construction of such models: poor modeling of the problem, the nature of evidence itself, and anchoring on a piece of information associating a solution with a past success. For example, people make decisions based on the most readily available evidence, which may not be the best evidence. They also often select alternatives that involve overcoming financial hurdles even if "better" alternatives exist.

4. Only a few of the possible alternatives are considered because the decision maker's knowledge of the situation is usually limited.
5. Few people search for the best possible alternative. Most will settle for the first alternative that minimally satisfies minimally considered objectives-what Simon calls "satisfying" criteria. People often do not seek the best decision, only the decision that improves, or satisfies, their situation and that time constraints allow them to make.
6. People base decisions on rules of thumb and frequently will not even evaluate alternatives according to specified criteria. Past experience is often the basis for making decisions.
7. The decision-making process, especially in the higher levels of an organization, is greatly affected by social relationships. Coalitions of decision makers vie for power. Problem solver's must gain the support of powerful individuals and coalitions to ensure that their solutions are chosen and implemented.
8. Decisions often occur in a series of small steps. There are few "great leaps," especially in large organizations.

In sum, while the economic model is widely accepted as the basis for decision making in organizations, the process is often anything but rational. It is also political, social, and "satisfying." what makes for the "best" decision is not always apparent. All decision makers must be aware of their own limitations and the constraints of the situation. They must also anticipate the political and social realities not only of the decision process, but of the implementation and control processes as well. This often requires participation, or "selling" the decision to others. People must recognize these constraints and work within them. They should also seek to reduce the limitations on the decision process.

Problem-Solving Styles and Tendencies

Historically, people have tended to deal with problems in three ways: by avoiding them, solving them, or seeking them out. Some people avoid problems by refusing to recognize that a problem or opportunity exists. For example, some believe that the Bush administration avoided the problem of the federal budget deficit rather than face it head on. Other people solve problems as they arise. IBM's PCjr was completely redesigned after it failed to penetrate the market. Although it was ultimately scrapped because it tried to meet the demands of a market that did not exist, IBM personnel met the problem head on.

Problem-seeking people actively search for potential problems or opportunities, attempting to anticipate them. Royal Dutch Shell, for example, is well known for its strategic-planning simulation systems, which actively monitor all the signals from its internal and external environments. The company has developed the ability to recognize even weak signals of potentially dangerous situations. Its rapidly changing environment caused it to do so.

Problem-Solving Styles

According to researchers James L. McKenney and Peter G. W. Keen, people develop preferences for one of two basic problem-solving styles: systematic or intuitive. These individual preferences probably stem from, or are at least partly related to, differing preferences for gathering and processing information. Systematic thinkers approach a problem in a logical and rational manner. They divide the problem into smaller parts, analyze each of them, reassemble the problem, and apply various complex analytical techniques to reach a decision. They tend to "look for a method, make a plan for problem solving, be very conscious of their approach, defend the quality of the solution largely in terms of the method, define specific constraints of the problem early in the process, discard alternatives quickly, move through a process of increasing refinement of analysis, conduct an orderly search for additional information, and complete any discrete analysis that they begin."

Intuitive thinkers are especially good at keeping track of many variables that may defy ordinary analytical techniques. The term intuitive implies that positions are reached without rational and analytical thought. The solution or the observation simply "comes to" the individual via insight. Intuitive thinkers tend to "keep the overall problem continuously in mind, redefine the problem frequently as they proceed, rely on verbalized guesses, even hunches, to find a solution, consider a number of alternatives and options simultaneously, jump from one step of analysis to research and back again, and explore and abandon alternatives quickly." Intuitive thinkers can handle extremely complex problems spontaneously. They seem to be able to view the entire situation better than someone who is strictly rational and analytical. Thus, against the advice of his attorney, Ray Kroc purchased a small hamburger chain because he had a feeling that the chain had tremendous potential. He was right with that decision, McDonald's as we know it was born.

Problem Solving and Ethics

So far, we have discussed creative problem solving primarily from a technical viewpoint. But people applying CPS often have wide latitude in making decisions, and significant pressures are often brought to bear on them to make the "right" decision. The values of the decision makers therefore greatly affect the outcome of the decision-making process.

How Much Participation, and When?

Managers need some way to determine when members of their work groups, individually or collectively, should participate in managerial decisions and when they should not-and how much they should participate if they do. These are not easy decisions to make. We gave some guidelines in the previous section, when we focused on individual versus group decision making, but the factors involved affect more than just the superiority of the decision.

The Manager as a Creative Problem Solver

The increased complexity of the managerial environment, the personalities and expectations of decision makers and other members of the organization, as well as the other management challenges noted in Chapter 1, are changing the way problems must be solved. Managers are not only moving toward more participatory decision making, but also responding to the need for the decision maker to be more creative and innovative.

Creativity results in something new that has value. Innovation results in something new that has significant value in an organization, industry, or society. Innovation is how firms make money from creativity. There are four types of innovation: product, process, marketing, and management. Many experts believe that innovation in the management process is essential if U.S. firms are to compete successfully in the 1990s and beyond. Many firms are actively seeking new ways of planning, organizing, leading, and controlling in order to become more competitive.

As society changes technologically, socially, economically, and politically and as customers and competitors change, the need for creative solutions increases. As firms become more competitive, as product life cycles are shortened, as more and more new entrants supply products and services in all market areas, more creativity and innovation are needed.

There are two other reasons for becoming more creative and innovative in problem solving: First, today the computer does the number crunching. Problem solver's no longer have to spend so much time on the mechanics of the process. They need to learn how to use information more creatively to make better decisions. Second, an intuitive individual who also uses rational and analytical approaches has an advantage over someone who is simply rational and analytical. Especially in complex problem-

solving situations, the intuitive person generates better decisions than those produced by the single-mindedly rational individual.

Creativity is extremely important at all stages of problem solving and decision making. Although we tend to think of creativity as being principally concerned with generating alternatives, it also takes creativity to analyze the environment, search out problems and separate them from symptoms, choose good solutions and implement them in an effective way, and develop effective control systems.

Achieving creativity in problem solving depends on the "four P's" of creativity: product, processes, possibilities, and personal creativity.

- **The product:** Creative services, products, or ideas result when the other three "P's" are present.
- **Processes:** Individuals or groups may use some one hundred processes to improve creativity, including three that we discussed earlier: brainstorming, storyboarding, and lotus blossom.
- **Possibilities:** Creativity also requires a certain type of organizational culture. Rewards must be provided, creativity must be encouraged, and open communication and trust should dominate. Innovative companies such as 3M, Hewlett-Packard, and Merck possess such organizational cultures. Milliken even has an "Innovator's Hall of Fame."
- **Personal creativity:** Creativity can be increased in two ways. First, most people have been socialized against being creative. Overly burdensome rules, regulations and procedures, and attitudes opposed to new ideas dominate most organizations. Therefore, employees need to be resocialized to overcome negative attitudes and noncreative habits. Second, several techniques can be used to develop intuition and improve creativity. Research by Weston H. Agor reveals that many top executives emphasize the importance of intuition in successful problem solving. They also emphasize, however, that intuition is only one way of approaching a problem and that rational analysis must come first.

Increasing Problem-Solving Effectiveness

The title of this section, "Creative Problem Solving," is intended to convey the importance of using creativity in problem solving. Unfortunately, most educational processes develop only systematic thinking skills. Although some decisions lend themselves readily to systematic thinking, others do not. The more complex, unstructured, and infrequent the decision, the more likely it is that intuition and creativity will be necessary. It has been shown, for example, that CEOs need to employ intuition in strategic planning because some complex problems almost defy rational approaches.

In addition to using greater creativity and intuition, however, people can increase their problem-solving effectiveness by working on the rational stages, for example, improving environmental analysis and problem identification. Problem solving can also be

improved by recognizing the conditions under which the problem is to be solved, the structure of the problem, the relevance of group decision making, and the behavioral factors involved. Finally, as group problem solving becomes more common, managers must learn facilitative skills like those developed in Work Groups.

Summary

- Creative problem solving is the core function of people. Problem solving consists of eight stages: environmental analysis, problem recognition, problem identification, making assumptions, generating alternatives, evaluation and choice, implementation, and control.
- Decisions are made under three principal conditions. Under conditions of certainty, alternatives, conditions, and probabilities are known and outcomes are certain. Under conditions of risk, alternatives and conditions are known and probabilities can be estimated; outcomes are unknown. Under conditions of uncertainty, alternatives, the number of alternatives, conditions, probabilities, and outcomes are all unknown.
- Problems can be placed on a continuum from highly structured, or programmed, to highly unstructured, or unprogrammed. Structured problems are routine and simple and lead to routine decisions. Unstructured problems are unique and complex and require one-of-a-kind solutions. Top managers tend to face more unstructured problems, whereas lower-level managers and employees tend to face more structured problems.
- The advantages of group problem solving include potentially superior solutions, greater acceptance of decisions, improved understanding, a broader information base, balanced risk propensities, and better collective judgment. The disadvantages of group problem solving include conformity, dominance by one person, the amount of time it takes to make a decision, and the phenomenon of risky shift.
- Theoretical explanations of decision making generally follow the economic model. However, the administrative model, which takes into account the behavioral aspects of decision making, portrays the process more accurately. Individual psychological, social, and political forces often enter into the decision-making process.
- People's problem-solving styles can be classified as either intuitive or systematic.
- Most organizations and many people, especially managers, will have to become more creative in the near future. Being creative requires learning creative problem solving techniques.
- Innovation is needed to solve contemporary management challenges and

problems. Creativity leads to innovation in the right kind of organizational culture.

General Questions

1. Why is creative problem solving everyone's responsibility?

2. Describe a decision you have witnessed or participated in as a member of an organization. Indicate which stages of the creative problem-solving process were followed.

3. Review the major decisions you have made in the last month. Which of these were structured and which were unstructured? Were they made under conditions of risk, uncertainty, or certainty?

4. Describe your organization's typical problem-solving process in terms of the classical and administrative models of decision making.

5. Describe the politics of decision making in organizations. Use personal examples.

6. Do you use rules of thumb in decision making? If so, describe them.

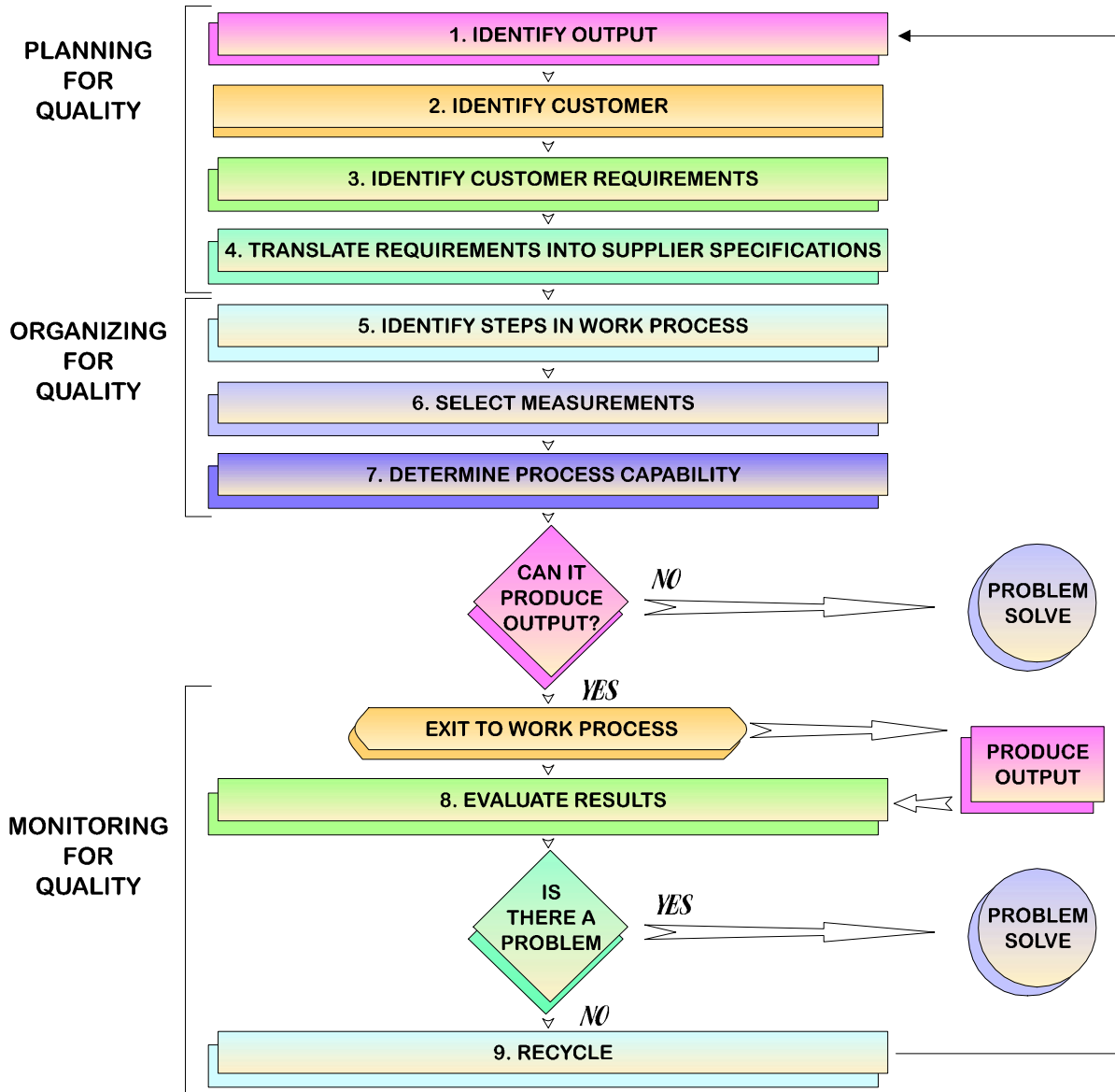
7. Review the pros and cons of individual and group problem solving.

8. What is your problem-solving style?

9. Describe each of the major types of problem-solving groups and how each might be used.

10. Why do we need more creativity in solving problems, especially in complex situations? Why do we need more innovation?

QUALITY IMPROVEMENT PROCESS



QUALITY IMPROVEMENT PROCESS

Please refer to the previous page to view the Quality Improvement Process.

PLANNING FOR QUALITY: STEPS 1-4

Questions to be answered:

- What is to be done?
- For whom is it to be done?
- What is wanted, needed, or expected?
- Is it measurable, realistic, and achievable?

Results to be achieved:

- Come to agreement--by both customer and supplier--on customer requirements.
- Increase the likelihood that things will be done right the first time.
- Eliminate activities for which there is no clearly identified customer or need
- Reduce likelihood of doing too much, or too little, based on assumptions of what the customer wants or needs.
- Eliminate activities with limited potential pay back before they start.
- Ensure the right of the supplier to question the customer about requirements.
- Increase confidence that those identified as customer and supplier are the appropriate ones to address the task.

Step 1

What is the Output?

Output:

A product or service you produce as part of your job and pass on to the next person in the work process.

For example:

- Report written
- Electrical subsystem wired

- Invoices generated
- Quarterly sales results analyzed
- Customer information data base updated

Guideline 1

The first word--the noun--should be quite specific and as tangible as possible. In the list above, reports, electrical subsystems, and invoices can be seen and touched. Even though sales results and customer information are a little more abstract, they may be represented by something written on a piece of paper.

Statements of output--like work completed, plans implemented, and attitudes changed are too broad or too vague to be very useful.

Guideline 2

The second part of the output statement is best phrased as a verb--a word that expresses what you do to produce the output. Again, this part of the statement should express what is left behind when the output is completed. If the subject is meeting, what is done or left behind?

Meetings	Planned? Scheduled? Recorded?
Reports	Researched? Typed? Distributed? Filed?
Widgets	Designed? Tested? Assembled? Packed? Sold?

Stated in this manner, outputs emphasize completed work. They convey a sense of accomplishment and purpose.

Guideline 3

Outputs shouldn't be so broad that they describe anybody's job:

- Objectives met
- People managed
- Communications achieved

On the other hand, they shouldn't be so narrow that they're insignificant;

- Terminal turned on
- Form filled in
- Phone call made

It is difficult to prescribe hard and fast rules, because what works for one level in the organization may not be appropriate for a higher or lower level. As a general rule, however, outputs tend to become more narrowly defined as you move from the top down.

The output should also reflect the focus of your quality improvement effort--the particular output that you want to improve. Here are some examples to give you an idea:

Too broad	About Right	Too Narrow
Staff Managed	Performance Reviews conducted	Reviews Signed
Market research program implemented	Customer reactions collected	Company XYZ contacted
Machines produced	Component designed	Tab A inserted in slot B
	Boards wired	

Guideline 4

The output should represent what you do, not what you're responsible for directing others to do. For example, a sales manager would not list machines sold as his or her output. That is the output of the sales rep. Some outputs a manager might have:

- Forecasts developed

- Selling strategies developed
- Sales reps coached

The supervisor of an assembly line would not list widgets assembled. Some outputs she might have:

- Schedules assigned
- Productivity charts maintained
- Training arrangements completed

Guideline 5

Results are not outputs.

Here are some results:

- Profit target achieved
- Customers satisfied
- Commitment obtained

Even though they're stated as outputs, these are the results of an array of outputs--sometimes hundreds of them--produced by many people within an organization.

Customer satisfaction, for example, results from the following outputs, among others:

- Sales proposal developed
- Machine sold
- Machine installed
- Customer inquiries answered
- Customer data collected
- Machine repaired
- Invoice corrected
- Machine replaced
- Preventative maintenance completed
- Suppliers delivered

The Customer's Role

As a customer, you are responsible for describing the outputs you need as clearly as possible. Even before the discussions about your requirements take place, you should be prepared to give your potential suppliers a detailed description of what it is you need. You should also be prepared for--and even expect--questions from suppliers about your needs.

Summary

An output is a product or service that you produce as part of your job and pass on to the next person in the work process. An output is expressed in a noun-verb format to stress accomplishments. For effective analysis, outputs should neither be too broadly nor too narrowly described. They should represent your work, as opposed to your team's. Finally, you should be able to distinguish your outputs from the larger results you want to achieve by producing them.

Step 2

Who is the Customer?

Because the definition of quality is meeting agreed to customer requirements, it's important to take some time to determine who is the customer for your output. When you have direct contact with an external customer, it's fairly obvious who the customer is. But all of us also have customers within the company--internal customers to whom we may not have given much thought before. A clearly defined output usually makes identifying internal customers easier.

customer:

The next person (or group) in the work process; the receiver of the output and the next to act on it. A customer may be either external or internal. While sales and technical representatives come in contact with external customers, many other company employees do not. All of us, however, have internal customers.

For example:

output

part designed
part manufactured
machine assembled

next in process

manufacturing engineer
production line operator
distribution manager

output

machine sold
sales order form completed
credit references verified
supplies order filled

next in process

external customer
order entry clerk
billing department specialist
external customer

Supplier:

The individual or group responsible for producing the output. Most of us serve in dual roles of customer and supplier. We shift roles frequently, depending on the output involved.

Secondary Customers:

Other customers, beyond the next in the process, who receive or make use of the output. When secondary customers are identified, the customer for whom the output is principally intended is called the primary customer.

For example:

<u>Output</u>	<u>Primary Customer</u>	<u>Secondary customer(s)</u>
Copy volume report published	District technical managers	Service representative Sales representative
District sales forecast generated	Region marketing manager	Region general manager Region service manager

End user:

The consumer, the final customer who makes use of the output. For example, the trainer is the curriculum writer's customer for the output problem solving training developed. The participants in the training sessions are the end users or consumers.

Guideline 1

The identification of customer requirements will be much easier if the customers have been identified by name. People, not departments or divisions, identify and agree on requirements.

If you are the supplier of the output budget discrepancies reported, don't stop at the bookkeeping department as the customer. Find out what individual in the department uses the output, and identify him or her by name.

For an output that has multiple customers, try to find a surrogate who can speak for all of them. For example, technical trainers have literally thousands of customer service representatives who are potential customers for their output technical training delivered. In that case, a team of CSR's could serve as surrogate customers for the entire population.

Guideline 2

The manager is not necessarily the customer for the output produced by his/her subordinate(s). The fact that a manager may inspect or monitor the output does not make him or her the customer for that output.

The manager's role is that of a co-producer working with the supplier, to establish achievable specifications; to determine the steps in the work process; and to remove the barriers that prevent people from producing outputs that satisfy customer requirements.

When the direction of the work process is upward (e.g., progress reports, recommendations) your manager may be the customer. For example, if you and your peers submit reports that are rolled up, forwarded, and rolled up again and finally processed by a headquarters office, your boss is the next person in the process. But ordinarily, look elsewhere for your customer before automatically assuming it's your manager.

Guideline 3

Even though you may not be delivering your output to the end user, it is important to know the line of customers leading to the final one. In order to do this, it may be necessary to chart the sequence of the process so as to get to know all the customers through whom your output passes. If each person in the process satisfies the requirements of the next person, you will, by definition, have produced a quality output.

Guideline 4

An output may have multiple customers. If several people must process your output for different reasons, each one is considered to be a customer for that output. For example, the output X-100 launch strategy developed has several concurrent customers--in manufacturing, distribution, sales, service, admin--each of whom will use the document as a starting point to develop their own outputs (e.g., X-100 service training developed). Each customer could have different requirements and their differences should be identified and reconciled by the customers and their supplier. (See step 3.)

Guideline 5

If you have identified yourself as the customer for an output, you are probably dealing with a step within your work process, not a true output.

For example, look at the output report drafted. Although others may be involved in reviewing the draft, it looks as if you are your own customer for the draft, because you are the one who uses it in producing the final report. In fact, drafting the report is actually a step in your work process to produce a written output report.

The Customer's Role

Being named the customer places certain responsibilities on you. If you agree that you are, indeed, a customer for the output, you should confirm that with the supplier. If you have been identified as a customer when you don't think you are, you must work with the supplier to clear up the confusion. By the same token, if you think that you are a customer but haven't been identified as such, speak up! Again, you'll have to work with the supplier to come to agreement about your roles.

Summary

The customer is defined as the next person (individual or group) in the process that receives your output and acts on it. There are internal and external customer, primary and secondary customers and suppliers, and end users. Try to identify customers by name. Your own output should advance the delivery of the final output to the end user, while reflecting his/her requirements. You may have one or more customers for the same output, and you may have to reconcile differences in their requirements.

Step 3

What are the Customer Requirements?

Requirements:

What the customer wants, needs, or expects of the output. Customer requirements may be general or very specific. As a rule, customer requirements fall into the following categories:

<u>Category</u>	<u>Example</u>
Timeliness	"I need that report by noon Friday."
Accuracy	"The computer will reject an incorrect account number."
Cost	"We've allocated \$4500 for this project, and we can't

	afford to go over budget."
Completeness	"Our department can't start processing those forms until we have all of them."
Quantity	"I'll need a gross of widgets delivered each week."
Dimension	"If the printer is more than 20-inches deep, it won't fit on the desk."

Customer requirements may come to you in many forms--from very general to very specific. You can think of them falling along a continuum, like the one below.

Output: Sweaters sold
Customer: Retail customers

General _____ **Specific**

Customer A

"I want a sweater that makes me look like Robert Redford."

Customer B

"I want a warm sweater that I can wear when I go to a casual cocktail party."

Customer C

"I want a blue wool, V-neck sweater, size 42, with raglan sleeves."

Guideline 1

The more specific you can encourage your customer to be, the better. Notice that the requirement to look like Robert Redford can be interpreted in many ways. Does that mean it must be blue? Wool? A particular cut? Accepting such a customer requirement may cause difficulty, because your idea of Robert Redford and the customer's may be very different. And it may not be possible to achieve that objective with a sweater!

As a result, you may give the customer a product or service very different from what was expected.

Guideline 2

It is important to determine what the customer's objective is. For example:

Output: Dogs sold
Customer: Retail customer
Requirement: "I want a male Doberman puppy."

As supplier, you may think those are good, specific requirements for a dog that you can meet easily. However, upon questioning the customer, suppose you find the following:

“I want a dog that will be good company for my children at home in our apartment.”

If you simply supply the Doberman puppy without asking about objectives, the customer is likely to return the dog, complaining that it didn't really meet the requirements. If you know your customer's objective, and you are more knowledgeable than the customer about your product or service, you may be in a position to propose other options. In the pet store example, you might say:

“How about a small mixed breed? I think that might fit your needs better because...”

Guideline 3

The customer is responsible for creating an environment in which suppliers are encouraged to ask for better and more precise requirements.

Since it is to both the customer's and supplier's advantage that things be done right the first time, the customer benefits by encouraging the supplier to ask for greater specificity. When the environment is conducive, there is much greater likelihood that misunderstandings will be minimized or completely avoided. This will also reduce the chances of exceeding customer requirements.

Output:	Status Report produced
Customer:	Your manager
Customer requirement:	“By 5p.m. on Monday, April 1, I want a status report on our major account program.”

If the manager has created an environment that discourages group members from clarifying assignments, this report could include many items that are not needed by the customer. If the customer is only interested in physical activity, time spent reporting information regarding service response time, billing problems, or customer VIP trips will represent a cost of non-conformance.

Guideline 4

Customer requirements can be identified by the supplier.

When the supplier has more expertise than the customer, the supplier should take the lead in helping the customer identify the requirements.

For example:

Output:	Telephone system proposed
Customer:	Department manager
Customer requirement	"I want a new telephone system that will improve our communications efficiency."

An expert supplier of telephone systems, working with the customer, will be able to refine the customer's objective into requirements so that the customer can respond to them. Discussions like this go back and forth, between customer and supplier, until both can agree on a set of requirements. Sometimes the discussion takes only a few minutes; other times it can take days or weeks, or even months.

Guideline 5

The supplier can negotiate customer requirements.

The customer who wanted the blue, V-neck, wool sweater might accept a crew neck sweater or a tan sweater. Some requirements might be absolutely non-negotiable (size, for example). A sale price might change the customer's style or color requirement, but it would not change the size requirement.

A manager requesting a status report by 5 p.m. Monday might be willing to accept a handwritten draft if it will give the supplier time to do a more complete job.

Negotiation of requirements is particularly important for outputs that may have multiple customers. One customer's requirement for accuracy may be in conflict with another's requirement for timeliness. The supplier must make customers aware of conflicting requirements and try to facilitate negotiations among them. If at all possible, the supplier should bring these customers together to discuss the requirements and try to reconcile the differences.

Sometimes customers have non-negotiable requirements that the supplier can't meet. Or the suppliers may feel that, even after negotiating requirements, meeting them is still beyond their capabilities. In such cases, the supplier should identify the situation at the earliest possible stage, when the customer has the greatest number of options to explore. For example, the customer could find another supplier, redefine the output, or decide not to pursue the output further.

Guideline 6

Not all customer requirements will be specified.

For example, the customer for the blue, V-neck, wool sweater may specify size, style, and color requirements. The customer may assume that the sweater will not unravel,

and the color will not run when cleaned. However, if the sweater does unravel, an unspecified requirement will take on tremendous significance.

When the customer identifies a requirement that is, normally taken for granted--beware! It usually means that the requirement has not been met by a previous supplier and thus has become more important to the customer.

The Customer's Role

This step of the quality improvement process requires--even demands--your active involvement. You should be as specific as you can about your requirements. If you have certain assumptions about the output, it may be worth your time to make them explicit. For example, you are the customer for the output X-100 project status reported. As a customer, you assume that the pages of the report will be numbered. The supplier may or may not have the same assumption. If having the pages numbered is important to you (e.g., for easy reference), let the supplier know. Otherwise, you may find that your assumed requirement has not been met.

It's also a good idea to share your objective with your supplier, who may have different, and sometimes better, ways of achieving that objective.

Finally, you should be willing to negotiate with the supplier about some of your requirements. If you are one of several customers for the same output, be open to negotiating with them as well.

Summary

Requirements are what the customer wants, needs, or expects of the output. Requirements range from general to very specific, and should relate directly to the customer's objective. Suppliers should be encouraged to ask for greater specificity when determining customer requirements. Customer requirements can and should be negotiable.

Step 4

What are the Supplier Specifications?

Whether you're a supplier of sweaters, puppies, reports, machines, or magazines, you provide an output that has certain specifications. These are the specifications you need to define precisely in order to produce the product or service you are going to provide to your customer.

specifications:

Translation of the customer requirements into supplier terminology; the detailed description of the output, based on the customer requirements.

For example, compare the customer requirements and specifications for the two outputs given below.

Output: Presentation developed

Customer requirement

Presentation about issues that has a good chance of getting budget approval

Specifications

Two-hour maximum
Up to 16 colored transparencies
Covering points X, Y, Z
15 copies for handouts
Presenter: Joe
30 minutes for Q&A
Request for \$7500
Ready by 1 p.m. Friday

Output: Report typed

Customer requirement

Type in draft form for approvals by A, B, C

Must be out by 5 p.m. today

Specifications

One-inch margins
Double spaced
Proportional spacing
Title centered
Subheads bolded
Stored on disk
Distribution to A, B, C in mailroom by 4 p.m. this afternoon

Guideline 1

Specifications must be based on and directly related to customer requirements. Each requirement must be matched up with a measurable specification. (See Guideline 2.) A good way to ensure this is to use a T-chart to match up requirements and specifications.

As the supplier, you may also have specifications that you need to complete the output, but which may not be related to a particular customer requirement.

Guideline 2

Specifications have to do with time and money, and with physical, measurable features and attributes of the output. Notice that in the examples above, each specification can be measured. You can, therefore, determine to what degree the specifications were satisfied.

Concise, innovative, attention-getting are not specifications; these, and terms like them, should not be used for specifications. If the customer requires a marketing plan that is innovative and specifies that it will be "jazzy," no one will know what to measure. The role of a supplier is to work with customers to define terms in more readily measurable ways. Concise could become "...in no more than five pages, using no more than four cost analysis charts." You must probe to find out that innovative may mean new distribution channels, or that "jazzy" means bright colors and sharp angled geometric designs. You may end up having to settle on the fact that there are some unmeasurable aspects of the customer requirement or supplier specification. But at least that will be agreed to before the output is produced, not after.

This is a deliberate process for both customer and supplier. It may mean agonizing over details that you never discussed before with your customer. It is the real key to "doing it right the first time." If, when you start out to produce your output there is absolutely no doubt as to any requirement or specification, you have done your planning well.

Guideline 3

Customer requirements can include some, or even all of the necessary specifications.

For example, the expense report form itself actually provides all necessary supplier specifications as to what data should be included and in what format it should be presented.

A customer who says, "I want to buy a men's, blue crew-neck, woolen sweater with a set-in sleeve, cable stitch, size 42, for under \$40" has provided most of the supplier specifications.

What is important is that specifications be identified, not who identifies them.

Guideline 4

Supplier specifications must be realistic and achievable.

The customer asks for 1000 widgets by October 1, at \$10 per unit. As the supplier establishes specifications, it may become obvious that all requirements cannot be met. Overtime is required to produce 1000 units by the deadline, or premium prices must be paid for components so that the delivery date can be met. The overtime costs or

premium component costs mean that the unit prices will exceed \$10. Five hundred units can be delivered at \$10/unit, but not 1000.

If the supplier is not realistic about what can be achieved, the customer and the supplier will both be disappointed. It is the supplier's responsibility to review specifications with the customer to ensure that the specifications will result in an output that meets requirements.

Note: It may be necessary to complete some of the activities in step 5 (Identify steps in work process) or step 7 (Determine capability of process to meet requirements) in order to establish a realistic, deliverable specification.

The Customer's Role

Having translated your requirements into measurable specifications, your supplier may ask you to review those specifications to ensure that nothing has been lost. Your responsibility is to help correct any discrepancies (if there are any) or give the go-ahead (if there aren't).

Summary

Specifications are the detailed description of the output as stated in the supplier's terminology. Specifications are based on the customer's requirements and should be measurable. Supplier specifications must be realistic and achievable and should be reviewed with the customer to ensure that they will result in an output that meets requirements.

ORGANIZING FOR QUALITY: STEPS 5-7

Questions to be answered:

- How will it be accomplished?
- What must be measured to ensure that it is successfully accomplished?
- Is the work process capable of delivering what is expected?

Results to be achieved:

- Ensure that measurement is meaningful, not just for its own sake.
- Shift emphasis from inspection to prevention.
- Enhance probability of meeting customer requirements.
- Provide clearer identification of content, sequence, timing, and resource requirements of job tasks.
- Enhance likelihood that process changes will be made before major problems occur.

Step 5

What are the Steps in the Work Process?

The purpose of this step is to use a systematic way of defining what must be done in order to produce the output. There are a number of formal techniques that can be used in this step. Some of the more familiar approaches are:

Flow charts
PERT (program evaluation review technique) charts project planning

For many outputs, the steps in the work process have already been defined and specified. These may be job aids, such as the step-by-step instructions printed on the back of the expense report form. Another example is the detailed technical material, such as the functional documentation (including flow charts) that is developed for each of the company's product. Policy and procedural manuals also specify steps in many functional and operational work processes (e.g., job posting, machine installation).

Guideline 1

Find out what documentation already exists for a given work process. Don't create more work by reinventing the wheel. Although some modification may be required, it's easier to build on something that exists than to start from scratch.

By the same token, don't overlook the benchmarking approach. Talk to others who are involved in the same (or similar) work process to find out what steps they follow.

Guideline 2

At a minimum, the work process steps must include major activities. The format should also include major milestones and measurement points. (See step 6, Critical Measurements.) It may also be useful to include inputs (i.e., your suppliers' outputs) that are the "raw material" for your work process.

Guideline 3

Complex work requires more detailed information than does simple work.

For example, a one-page outline is sufficient to describe the work process for completing an expense report. A service representative, however, may require dozens of pages of functional documentation to describe the steps required to complete the troubleshooting process.

The Customer's Role

Although organizing the work process is primarily the responsibility of the supplier, the customer can be involved at this point. Some customers may want to review the planned work process as one way of ensuring that it will produce a quality output. Others may want to be sure that review points or milestones have been built into the work process.

Sometimes the customer is more knowledgeable than the supplier. Suppose your manager, who's been preparing a monthly report for the last several years, delegates part of that assignment to you. You now have an output whose customer knows much more about how to produce it than you do. In cases like this, the customer can--and should--serve as a resource to the supplier.

Step 6

What are the Critical Measurements?

In quality improvement, the emphasis is on prevention of errors, rather than on their detection and correction. Quality must be built into the output throughout the work process. It is impossible to "inspect" quality into an output at its completion.

Measurement:

A systematic plan for collecting information about the quality of the output. Measurements should accomplish the following:

Provide early identification of potential problems and actions required to improve the probability of meeting customer requirements.

Lead to the prevention of errors.

Permit objective evaluation of the quality of the output.

Guideline 1

Measurements should be derived from customer requirements and supplier specifications. That's why it's so important to have measurable specifications for customer requirements.

Guideline 2

What you are going to measure and how you are going to measure should be decided before the work process begins. Measurements can be divided into three categories, depending on when they are applied:

- Before measurements
- During measurements
- After measurements

We will look at each in turn.

Before Measurements help you answer the question:

What's the likelihood that the work process, as outlined, will produce a quality output?

Another name for before measurements is process capability measurements. In other words, you want to find out if the work process is capable of meeting customer requirements.

As indicated by the name, you apply before measurements before you actually start to produce the output on this particular occasion. You answer the question about process capability by looking at historical data.

For example, you probably have a "work process" that you follow to get to work every morning. You know that, on the average, when you leave at 7:30 it takes you 20 minutes to drive from home to work. When you left this morning at 7:30, a.m. you had made a process capability decision that you'd get to work on time.

Suppose that tomorrow morning it's raining heavily. You know that traffic is much worse in the rain, and that your usual "process" of leaving at 7:30 won't get you to work on time. So you adjust your work process by leaving at 7:15.

If you had heard by way of the radio that an overturned tractor-trailer had created a major slowdown on the highway that you usually take, you would probably change your route as well as leave a little earlier.

In fact, what you've done is measure how long it takes you to get to work under a variety of circumstances. Most of the time, your usual process (leave at 7:30, take the interstate, etc.) gets you to work in plenty of time. Under other conditions, you have to change your process by leaving earlier or taking a different route. Your measurements allow you to prevent the mistake of arriving late.

That's really what process capability measurements are all about: using data and experience to adjust your work process so that you're reasonably comfortable that you will meet the specification. Some typical process capability questions you might ask:

- How long did it take to produce this report each month in the past?
- How many copies did this machine make after the last time it was repaired?
- What was my customer's evaluation of this output the last time I produced it?

If you're working on a new output, something that you've never produced before, you won't be able to answer questions like those noted above without some help. But, you may have done something very similar, or you may be able to ask someone else. (You're downtown, with a rental car, in a city you've never visited before. You have to get to the airport to catch a 6:15 flight home. How do you know what time you should leave for the airport? You certainly wouldn't "guess"; you'd ask people who live there. They have the answers to the process capability questions!)

You may decide that you will have to evaluate your process by doing a test, making a pilot run, or building a model. All of these are ways of checking your process capability on a small scale before you commit all your resources to an untried process. (This would be like making a trial run to the airport to be sure you know the way and you can make it in the time you've allotted.)

During measurements:

Once you've decided the measurements you want to look at before you start producing your output, it's time to think about what you want to check "along the way." In-process measurements will tell you, at a given point in the work process, how well you're doing. Again, the objective is to help you prevent errors as early as possible in the process.

Let's go back to the example of driving to work. You know that 10 minutes after you leave home you should be at about the half-way point of your commute. If you're not,

that's your first indication that you could be late. But there's still time to make a mid-course correction, by taking the back roads, for example.

To select your in-process measurements review your entire work plan. Ask yourself, "Where are the risk points in the plan? If something were to go wrong, where and how would I be able to get the earliest indication of the problem?" Then place a measurement at each critical point in the plan. Often measurements are needed at points where you expect input from your suppliers. If the input is late, incomplete, or inaccurate your plan may be in jeopardy. A sales representative may decide that unless he or she has a certain number of potential sales by a certain time of the month that the month's sales targets are at risk. By monitoring key indicators, the sales representative knows when to take some corrective action early enough to still make the plan.

Quality control experts have developed many tools and techniques for monitoring critical aspects of repetitive processes. In your Concepts of Quality workbook you read about quality control charts that are used frequently to help people spot problems in their work processes.

After measurements:

These are the measurements you take after you have produced the output and delivered it to your customer(s). Also known as evaluation measurements, these represent the acid test of quality: Did you meet your customer's requirements? Did you deliver a quality output?

Answering these questions requires following up with your customer. You have to decide what questions you want your customer to answer, how you're going to ask them (in person? in writing?). And finally, you have to plan how you can use the evaluation data to improve the output in the future.

We discussed the use of a T-chart to match requirements and specifications. The same approach can be used for recording your measurements and deciding how they fit in with the steps of your work process.

Guideline 3

Concentrate on the vital few--those measurements that provide essential information about the quality of your output.

Some measurements may require only a yes or no answer, while others involve some sort of counting. If you're using a checklist as a way to measure the completeness of your output, for example, a check means yes, a blank means no. Either the raw material was in stock on the 15th of the month, or it wasn't.

Some examples of countable (sometimes referred to as quantitative) measurements:

- The number of orders received in January
- The number of ideas submitted to the suggestion system
- Hours of machine downtime
- Number of copies made since last service call

For most work processes, you'll use a combination of both types of measurements.

Guideline 4

As in step 5, find out what measurements already exist for the steps in the work process. Evaluate these measurements against the criteria for quality improvement.

- Does it predict the outcome, as early as possible, in the work process?
- Does it facilitate preventing errors?

Some existing measurements may be modified, others discarded, and new, more effective measurements developed.

Guideline 5

If you are dealing with a new work process, you have no obvious sources of data. Try to locate comparable data from which you can generalize. Some sources:

- Similar work process--Is there a current work process that resembles aspects of the process under evaluation? How well is it working?
- Competitive benchmarking--How well is someone else's process working? This doesn't have to be a competitor; it could be someone in another department, or someone in the same function in a different organization.
- Competitive benchmarking--How well is someone else's process working? This doesn't have to be a competitor; it could be someone in another department, or someone in the same function in a different organization.

Using the best data available, evaluate the process as described in Guideline 1.

The Customer's Role

The customer, better than anyone else, can help the supplier determine which measurements are the critical ones for ensuring a quality output. Customer involvement in selecting measurements can help the supplier focus on the "vital few." The customer can also help the supplier understand why the key measurements are so important.

Even if the customers aren't directly involved in selecting the measurements, they will be involved in collecting the measurements. Data obtained after measurements, in particular, will come from customers.

Step 7

Can the Work Process produce a Quality Output?

The purpose of this step is to determine if the process you have selected is capable of producing the desired output—one that meets the specifications agreed to by both customer and supplier. The focus of this step is the future: Will this work process enable me to produce an output that satisfies customer requirements? (Contrast this with step 8, where you evaluate results: Did the work process result in an output that satisfied customer requirements?)

Guideline 1

Follow the before measurement plan you selected in step 6.

Now is the time to collect and evaluate the data you need to help you make the decision about process capability. You need to feel confident that the time and resources applied to the work process will result in quality, not scrap and rework.

If your measurements indicate that all systems are “go”, you follow the steps in your process to produce the output. Remember to take measurements along the way—your during measurements.

Guideline 2

If, on the other hand; your before measurements don't leave you feeling confident, this is the time to use problem solving to revamp the work process. You may have to repeat your process capability test using your revised work process.

Guideline 3

What if your repeated attempts to revise the work process still leave you with a process that is not capable of producing an output that meets the customer's requirements? Talk with the customer. The customer needs to know what to expect. A renegotiation of the requirements maybe possible. The customer may want to find another supplier.

The Customer's Role

Although the supplier has the primary responsibility to assess the capability of the work process, the customer does have a role to play. The customer can help by expecting that the supplier will take action to ensure that the process is right. A good customer asks questions like:

- "What results have you had from this process in the past?"
- "How much variation do you expect in the output?"
- "Would you like me to check a sample from the process before you go full scale with it?" A responsible customer doesn't say:
 - "Just go with your best shot; we don't have time to test it." Or...
 - "Give me something by the deadline. We'll sort out the problems and fix them later."

As a customer, the company has developed a strong interest in the capability of the work processes of its outside suppliers--the companies that supply parts for the equipment we produce. The strategy has been to reduce the number of different suppliers so that we can work more closely with the remaining ones to understand their process capability issues and assist them in establishing controls that ensure the quality of the parts we buy.

Our cost targets no longer allow us to inspect all the parts we receive. Instead, we must work with our suppliers and only buy from those with processes capable of meeting our requirements.

MONITORING FOR QUALITY: STEPS 8-9

Questions to be answered:

- Are changes required in the process?
- Where are there additional opportunities for quality improvement?

Results to be achieved:

- Ensure a clearer understanding of current level of performance.
- Improve ability to isolate problem causes.
- Establish quality improvement as a moving target.

Step 8

Did the Output meet Requirements? How can it be improved?

This step is evaluation of the results. Evaluation of results must be based on the specifications that customer and supplier agreed to as part of step 4 (determine supplier specifications). Those specifications represent a template against which the results are measured.

The approaches used in step 7 (determine process capability) are appropriate here as well. There are two major differences between this step and step 7:

- You are evaluating how well you did. The emphasis is on results rather than on process.
- You always have data from the work process.

Evaluation of results often leads to the identification of a problem with the output. Some examples:

- The report was delivered on time, but two of the pages were missing.
- Three of the five meeting objectives were not achieved.
- Three of the five meeting objectives were not achieved.

This identification of problems leads into the problem-solving process, and a systematic search for ways to solve them.

The Customer's Role

The customer has an important role in evaluating the results. The supplier can check some of the results quite easily against the specifications--timing, cost, amount, accuracy, etc. Other requirements may be more subjective and difficult for the supplier to evaluate without the participation of the customer--requirements such as style, effectiveness, relevancy, courtesy and so on.

If the supplier fails to request feedback from the customer, it is still in the customer's interest to provide it. In some cases the output may conform to all the agreed-upon requirements and still fail to meet the customer's objective. When this happens, the customer and supplier will want to explore together additional requirements to ensure a quality improvement the next time around.

Step 9

What's Next?

Based on the application of the previous steps, particularly step 8, you can make a decision as to how to proceed.

If the evaluation in step 8 clearly indicates a problem with the output, then apply the steps of the problem-solving process. This is the most effective way to identify the cause of the problem and to determine the most appropriate solution.

Even if no clearly defined problem emerges from step 8, the evaluation will allow you to gauge the opportunity for further quality improvement of your output. If there is a significant opportunity, then you should recycle and apply the process from the beginning. This is also the appropriate course if your customer's requirements are likely to change. An output that meets requirements today may not be a quality output tomorrow.

Another approach involves brainstorming the ways in which the quality of the output could be improved in the future. Some key questions to consider:

- How could this output be produced more efficiently?
- How can we prevent or eliminate any errors encountered in producing the output?
- How can we improve our measurements and their usefulness?

If the evaluation in step 8 indicated that you had produced a quality output (congratulations!), it may only be necessary to monitor your work process (step 7) and results (step 8) on a regular basis to ensure that you maintain that quality. In that case, you could identify another output and apply the quality improvement process to it.

FLOW CHARTING

Flow-charting is a graphical way of viewing a process. It resembles a road map and makes it easier for us to negotiate all of the steps needed to deliver required customer output from your required input. The following pages demonstrate the shapes and descriptions associated with flow charts.

It is not necessary to know all of the different shapes and their meanings at this time. They are provided to demonstrate how complete a process can be developed with flow charting. The use and application of flow charts will be demonstrated hands-on during the course of writing processes.